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NATIONAL GEOGRAPHIC

Untold Stories of D-DAY

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THE COVER

Twenty-four men died, but 260 others—and Old Glory—survived the sinking of the destroyer U.S.S. *Corry* on D-Day. Lt. Paul Garray rescued the flag after the ship hit a mine in the Bay of the Seine.

BY MARK THIESSEN

Cover printed on recycled-content paper

ON THE NGM WEBSITE

nationalgeographic.com/ngm/0206

SIGHTS & SOUNDS Experience the hope and horror of D-Day.

D-DAY Listen to veterans' stories in our Memory Book.

AFGHANISTAN Lois Raimondo tells her frontline tales.

GLOBAL GETAWAYS International editors rate favorites.

THE NISSAN ALTIMA. Given the choice, right feet prefer performance to anemic precision-engineered to dispatch you and all of your personal belongings in item-

*Motor Trend, September 2001. Altima 3.5 SE V6 with manual transmission. Nissan, the Nissan Logo, DRIVEN and Nissan Model Names are Nissan trademarks. ©2001 Nissan North America, Inc.

transit. Hence, the new Nissan Altima's 3.5-liter V6 powerplant: scattering time. "0-60 mph in 6.28 seconds." (*Motor Trend*)*

DRIVEN.

From the Editor

Most of us know or knew them. Many of us are related to them. Every one of us owes them a giant debt of gratitude.

They are the Yanks, Canadians, Brits, Aussies, Kiwis, Russians—as well as brave men and women from a dozen other countries—who were united in a great cause. They served as soldiers, sailors, fliers, and nurses in World War II. Thousands of them were never able to return to the nations they'd left to serve. They were buried at sea or lie in graves in Europe and throughout the Pacific, Asia, and North Africa.

One day now symbolizes the turning point in the Allies' long struggle: June 6, 1944. D-Day, as it came to be known, was their courageous response to the darkness enveloping the European continent.

Fifty-eight years have passed, but these days Americans tend to think in decades—fifty years, sixty years. So why should we look back at the Normandy beachhead now? Why not wait for the sixtieth anniversary?

The answer for me is simple: because of the survivors. We are losing more of these heroes every day, and I want those who are still with us to know that we will never forget what they did.

In this issue you'll find a previously untold story of that sixth of June. It is a look at the sea and sky of Normandy and the perilous journey of those who supported the landing troops. I hope that our focus on the story of the Americans who fought and died on Omaha and Utah Beaches can stand for all who sacrificed. I also hope that this will help us understand a little better the intensely personal nature of June 6 and of every other battle in the war. It may have been a global conflict, but a soldier's universe existed only a few feet to either side—perhaps only as far as his buddy to the right, or the bullets screaming by, or the explosions rocking the beach beneath his boots.

World War II defined good versus evil for a generation. Let us honor the sacrifice of that generation by quickly confronting evil wherever it raises its head again. Let us rededicate ourselves to ensuring that it never again is given the opportunity to imperil the world.

Bill Allen

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Forum

February 2002

Stories on sprawl in Salt Lake Valley, infectious diseases, and the "Stans" of Central Asia caused readers to question humankind's population growth. "What is often perceived as a shortage of food, arable land, jobs, housing, schools, and health care is usually a 'longage' of people," wrote a reader. Many felt the world's more visible problems were just symptoms of this underlying, yet far-reaching issue.

Central Asia Unveiled

Having lived and traveled in all of the Stans, I wholeheartedly agree with your description of the rigidness by which the majority of these countries are ruled, and the tenuous chances they have to break through the economic, political, and social chaos rocking their very souls. If any of these countries are to make real gains, it will be by improving the rule of law (through benevolent dictatorship or democratic values), which keeps foreign investment flowing.

J. L. JACOBS
Lebanon, New Jersey

It was disappointing that the ten statistics you provided on each country did not include their population growth rates. They range from .03 percent in Kazakhstan to 3.5 percent in Afghanistan. At that rate Afghanistan's population will double in 20 years.

THOMAS P. McKENNA
Montpelier, Vermont

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In your article on the Stans, the map on page 119 shows Kashmir as a part of India. Pakistan came into existence in 1947, and since then the northeastern region, Kashmir, has been a disputed territory. The people of Kashmir have never been given the right of self-determination and have been fighting a war for their independence. United Nations resolutions support that area as a disputed territory.

MUHAMMAD QASIM CHOUDRY
Galesburg, Illinois

As noted on our map, India's claim to Kashmir is exactly that, a claim. For more on the disputed region see "Kashmir: Trapped in Conflict," NATIONAL GEOGRAPHIC, *September 1999.*

Search for a Cure

I am a student of anthropology who has conducted research into local interpretations of HIV/AIDS in the Venda region of South Africa. The depressing conclusion to your article is that without a cure there is no hope, but this is too simplistic. To achieve real progress in the worldwide fight against HIV infection, there must be more sensitivity shown toward how people in other societies understand the virus. Only then can

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Challenges for Humanity

Jimmy Carter asks how we can heal our planet. He suggests sharing wealth. Solving global problems by equalizing wealth to the U.S. standard is hypocritical. More wealth equates with increased consumption of natural resources. Money cannot save Earth; a global shift in consciousness toward the deeper meanings of life is needed to change the course of the future.

CHRIS MORTIMER
Wawa, Ontario

I enjoyed "Challenges for Humanity" by Jimmy Carter. The article addressed problems not with pessimism but with realistic optimism. As a 15-year-old I would like to see a much cleaner, healthier, and more united Earth. When awareness is raised, people begin to seek change, which I hope to do.

TRACE WILSON
Rose Hill, Kansas

ELI REED, MAGNUM PHOTOS

In vain did I search Jimmy Carter's introduction and the following article for those magic words: birth control. Like a phantom, the word "overpopulation" entwined itself around each line, silently crying out to be enunciated.

PETER VOS
Uvongo, South Africa

Carter states that global population may soar from six to ten billion in the next 98 years. He then speaks of the need to overcome disease. If disease is eradicated, what effect will that have on population growth? The primary issue should be controlling our soaring population, which would go a long way toward solving many other problems. Ignoring this growth makes disease and disaster inevitable.

ELIZABETH JAEGER LAWSON
Morgantown, West Virginia

preventive strategies be culturally sensitive to that understanding, and thus be effective. Let's face it, prevention is the only cure to HIV/AIDS.

FRASER G. MCNEILL
Greenock, Scotland

While millions are spent on "safe sex" education, the truth is quite often ignored. AIDS became an epidemic, for the most part, because of lifestyle choices. Until humans choose a chaste lifestyle before finding a life partner and a monogamous relationship, AIDS will continue to spread.

DOUG ANDERSON
Dalmeny, Saskatchewan

WRITE TO FORUM

National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199, or by fax to 202-828-5460, or via the Internet to ngsforum@nationalgeographic.com. Include name, address, and daytime telephone. Letters may be edited for clarity and space.

I congratulate you on your very comprehensive article about HIV/AIDS. I nevertheless believe it is incomplete in that it fails to mention two very important facts about my country. First, notwithstanding South Africa being the most scientifically advanced country in Africa, it also has the distinction of having more cases of HIV than any other country. Second, our president [Thabo Mbeki] misguides our youth by telling them that HIV does not cause AIDS. Do you suppose there is a connection between these two facts? He is likely to be unopposed when he comes up for a second five-year term in 2004.

PAUL N. MALHERBE
Cape Town, South Africa

The pharmaceutical industries of the world are not interested in curing or healing disease of any kind. There is no money in it. Healing AIDS and many other diseases starts with healing the body-mind-soul complex, which modern medicine is ill-equipped to look at or simply chooses to ignore. Much more could be done with clean water, nutritious foods, and simple sanitation for most of the world.

KELLEY ELKINS
Doña Ana, New Mexico

Salt Lake Valley

The sad tale of the valley is that until the late 1940s three high-speed, inter-urban rail lines extended the length of the Wasatch Range, from Preston, Idaho, to Payson, Utah. But in the name of freedom and progress they were discarded in the bankrupt American philosophy of "if you don't drive, you don't count." At least the wise new generation of Mormons is putting back a fraction with TRAX, Utah's new light rail system, within the city.

BILL WRIGHT
Cranford, New Jersey

Two wo[illegible] [illegible]ply for jo[illegible] [illegible]ey look exactly ali[illegible] [illegible] [illegible] they [illegible] the [illegible] last [illegible] [illegible] [illegible] number. [illegible] [illegible] born [illegible] [illegible] same [illegible] [illegible] the same [illegible] [illegible] [illegible], same year. [illegible] [illegible] identical. [illegible] [illegible] says, "You must be [illegible]" [illegible] [illegible] [illegible]

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[illegible]
[illegible]-BUY-FORD [illegible]

I was stationed at Hill Air Force Base, Utah, in the early eighties. I am thankful to have had the opportunity to enjoy the area prior to the burgeoning population explosion. As your article pointed out, the rapid expansion of the population is not generated by outsiders coming in but is generated from within by a long history of Mormon Church doctrine. Perhaps the church elders should rethink this policy and slow population growth rates before there is nothing left of the beauty of the Wasatch mountains. I believe that when Brigham Young descended into the valley, he said, "This is the right place." If this place is ruined, there will be no other places to relocate to.

GREG FEUERBACH
Tucson, Arizona

I found myself disappointed in what I read in your article about Salt Lake Valley. While generally factual, it did nothing to enlighten readers about our state, culture, peoples, or history. It was a one-sided story about the environment and all that is not environmentally correct in Utah. What a lost opportunity. Utahns know what our trials and troubles are and are working to resolve them.

MARLELL A. NIELSON
Sandy, Utah

War on Disease

I was disappointed to see no reference to the work of the Rotarians. Rotarians from all around the world have been working to eradicate polio since a pilot program began in the Philippines in 1979. We have made a commitment to eradicate it by 2005—the hundredth anniversary of the founding of Rotary, and we will do it. We are nearly there.

IAN SAYERS
Hawker, Australia

You devoted a whole article to HIV and never mentioned hepatitis C, which is similar in the way it mutates itself to avoid destruction by antibodies. You should make people aware of this silent killer. It may be today's greatest threat to the liver, and most people don't even know they have it. This disease infects four million Americans and more than 200 million people globally.

WILLIAM JANSSEN
Nepean, Ontario

You should make people aware of this silent killer. It may be today's greatest threat to the liver, and most people don't even know they have it. This disease infects four million Americans and more than 200 million people globally.

On page ten of this otherwise informative article, the photograph depicts the poorest infection-control methods I have ever seen. We see a woman with a syringe in her mouth handling chickens being tested for the West Nile virus. As a registered nurse of 22 years, I was stunned to see such a lapse of infection-control practices with a potentially deadly virus.

JANET WILLIS
Montezuma, Georgia

ZipUSA: Elkton, Maryland

As my husband and I approached the 65th anniversary of our elopement to Elkton, we were especially interested in the article. In February 1937 during our ferry ride across the Delaware River, a surprise blizzard began. Undaunted, we went to a jewelry store in Wilmington and bought a wedding ring for seven dollars and then headed to Elkton, where we were married. Because of zero visibility on our way home, we took a wrong turn and slammed into a bridge abutment in Centerton, New Jersey. I spent my wedding night receiving facial stitches. While we had planned to keep our marriage a secret until my husband graduated from Duke University, the news quickly spread.

JANE N. ZAMBONE
Vineland, New Jersey

Geographica

I have looked closely at the picture of the location of the wound on the Iceman. First, the wound is obviously healed without any external evidence of injury. That arrowhead would have had to have been in that man's body for some time—maybe years—to heal that well. Secondly, because the arrowhead is relatively superficial and lying on top of the scapula, I seriously doubt it was fatal.

TERRI OSBORNE, M.D.
Ada, Michigan

"I have two arguments to support my theory," replies Eduard Egarter Vigl, the Iceman's caretaker, "my eyes, and an endoscope." Although the small, unhealed wound is not obvious in the published photograph, it is plainly visible in close-ups sent to us by Dr. Vigl.

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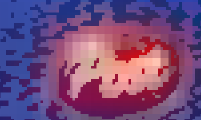

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Spitfires Scorch the Skies

[illegible]

As a boy in occupied Holland during World War II, Karel Bos used to see low-flying British Spitfires and dreamed of flying one of his own someday. By the time he was in a position to buy one, though, Spitfires, which were used by the Royal Air Force between 1938 and 1956, were no longer being made. Some 22,000 of the fighter planes had been [illegible]

[illegible]

[illegible]

RICHARD THOMPSON

SPORT

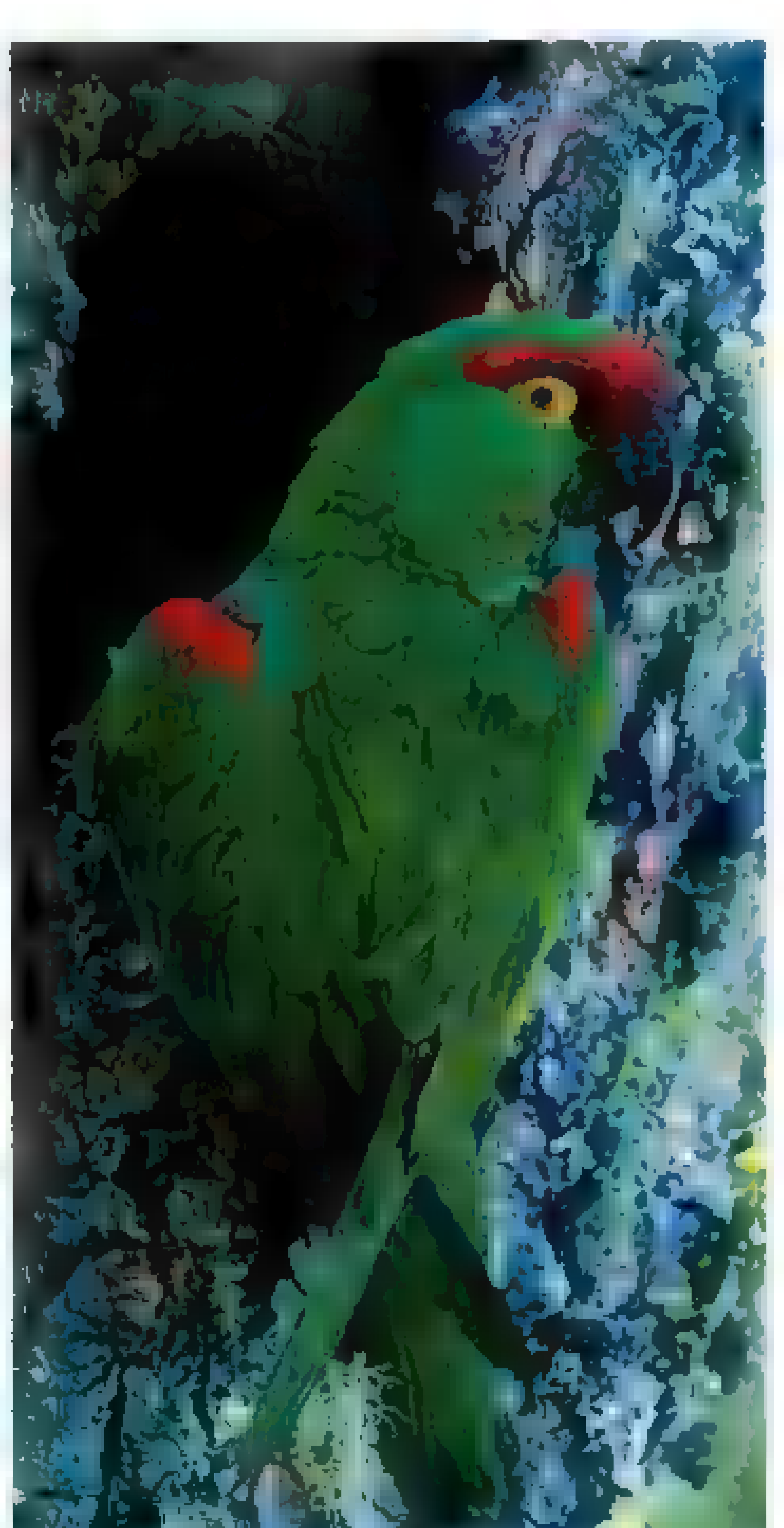
Chinese Soccer Finally Scores

Asia and the world get ready for the 2002 World Cup

When China qualified for the World Cup soccer tournament for the first time last October, hundreds of thousands of Chinese celebrated in Tiananmen Square. Makes sense: The world's most populous country loves the world's most popular sport.

Now South Korea, co-host with Japan of the 32-team tournament this month, is preparing a special welcome for some 60,000 Chinese soccer fans. Tourist visa procedures have been streamlined. Restaurants have changed their menus, hotels have added rooms, and some 1,700 Korean street signs have been translated into Chinese.

The location of this year's World Cup—the first to be held in Asia—has impacted other regions too. Some pubs in the U.K. are applying for extensions of current liquor laws so that they can sell beer at 6:30 a.m. to fans who thirst for a pint or two while watching matches played nine time zones away.



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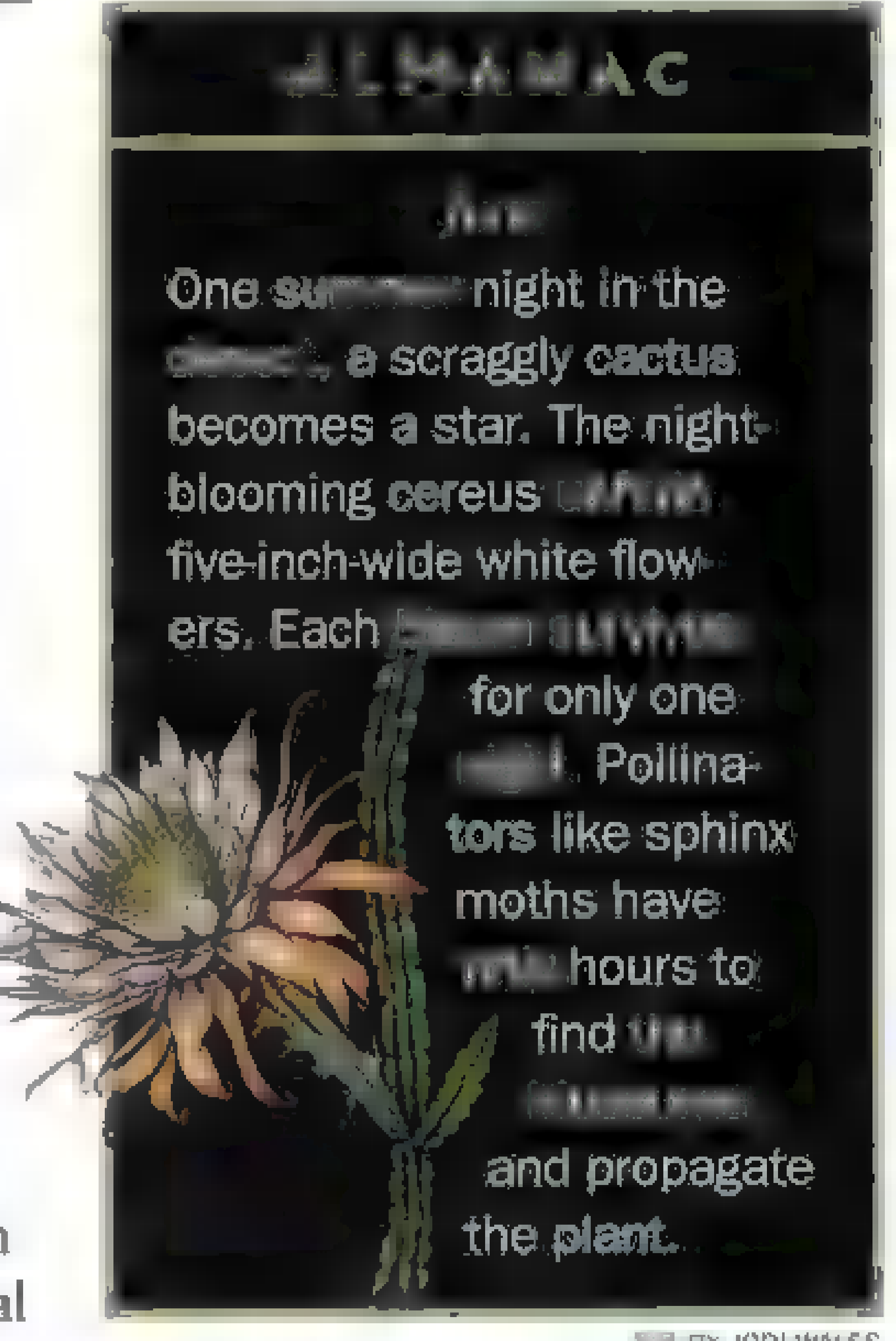
CONSERVATION

Co-op Aids Parrots

Thick-billed parrots can be heard a mile away, but fewer of them are squawking these days. Only about 1,500 breeding pairs survive in northwestern Mexico's Sierra Madre Occidental. They nest in old-growth conifers, which are increasingly falling to chain saws. About a hundred pairs of parrots live on a 40,000-acre land cooperative called an *ejido*. In late 2000 the ejido reached an agreement with the Wildlands Project and several Mexican conservation groups, including Pronatura and Naturalia. They will pay the ejido about $8,000 a year for 15 years to leave 6,000 acres of the land unlogged.



BY JODI WALES

WEBSITE

Find links and resources selected by our Research Division at nationalgeographic.com/ngm/resources/0206.

Fight Allergy-face!

For intranasal use only.
Shake Well Before Using

BRIEF SUMMARY

CONTRAINDICATIONS

Hypersensitivity to any of the ingredients of this preparation contraindicates its use.

WARNINGS

The replacement of a systemic corticosteroid with a topical corticosteroid can be accompanied by signs of adrenal insufficiency and, in addition, [illegible] patients may experience symptoms of withdrawal; *e.g.*, joint and/or muscular pain, lassitude and depression. Patients previously treated for prolonged periods with systemic corticosteroids and transferred to topical corticosteroids should be carefully monitored for acute adrenal insufficiency in response to stress. In those patients who have asthma or other clinical conditions requiring long-term systemic corticosteroid treatment, too rapid [illegible] decrease in systemic corticosteroids may [illegible] exacerbation of their symptoms.

Children who are on immunosuppressant drugs are more susceptible to infections than healthy children. Chickenpox and measles, for example, can have a more serious or even fatal course in children on immunosuppressant doses of corticosteroids. In such children, or [illegible] adults who have not [illegible] these diseases, particular care should be taken to avoid exposure. If exposed, therapy with varicella-zoster immune globulin (VZIG) or pooled intravenous immunoglobulin (IVIG), as appropriate, may be indicated. If chickenpox develops, treatment with antiviral agents may be considered.

PRECAUTIONS

General: In clinical studies with triamcinolone acetonide nasal spray, the development of localized infections of the nose and pharynx with *Candida albicans* has rarely occurred. When such an infection develops it may require treatment with appropriate local or systemic therapy and discontinuance [illegible] treatment with **Nasacort AQ** Nasal Spray.

Nasacort AQ Nasal Spray should [illegible] used with caution, if at all, in patients with active or quiescent tuberculous infection of the respiratory tract or in patients with untreated fungal, bacterial, or systemic viral infections or ocular herpes simplex.

Because of the inhibitory effect of corticosteroids, in patients who have experienced recent nasal septal ulcers, nasal surgery, or trauma, a corticosteroid should [illegible] used with caution until healing has occurred. As with other nasally inhaled corticosteroids, nasal septal perforations have been reported in rare instances.

When used at excessive doses, systemic corticosteroid effects such as hypercorticism and adrenal suppression may appear. If such changes occur, **Nasacort AQ** Nasal Spray should be discontinued slowly, consistent with accepted procedures for discontinuing oral steroid therapy.

Information for Patients: Patients being treated with **Nasacort AQ** Nasal Spray should receive the following information and instructions. Patients who [illegible] immunosuppressant doses of corticosteroids should be warned to avoid exposure to chickenpox or measles and, [illegible] exposed, to obtain medical advice.

Patients should use **Nasacort AQ** Nasal Spray at regular intervals since its effectiveness depends on its regular use. (See **DOSAGE [illegible] ADMINISTRATION**.)

An improvement in some patient symptoms may [illegible] seen within the first day of treatment, and generally, it takes one week of treatment to reach maximum benefit. Initial assessment for response should be made during this time frame and periodically until the patient's symptoms are stabilized.

The patient should take the medication as directed and should not exceed the prescribed dosage. The patient should contact the physician if symptoms do not improve after three weeks, or if the condition [illegible]. Patients who experience recurrent episodes of epistaxis (nose bleeds) or nasal septum discomfort while taking this medication should contact their physician. For the proper [illegible] of this unit and to [illegible] maximum improvement, the patient should read and follow the accompanying patient instructions carefully.

It is important to shake the bottle well before each use. **Also, the bottle should be discarded after 120 actuations since the amount of triamcinolone acetonide delivered thereafter per actuation may be substantially less than 55 mcg of drug.** [illegible] not transfer any remaining suspension to another bottle.

Carcinogenesis, Mutagenesis, and Impairment of Fertility: In a two-year study in rats, triamcinolone acetonide caused no treatment-related carcinogenicity at [illegible] doses up to 1.0 mcg/kg (approximately 1/30 and 1/50 of the maximum recommended daily intranasal dose in adults and children on a mcg/m² basis, respectively). In a two-year study in mice, triamcinolone acetonide caused no treatment-related carcinogenicity at oral doses up to 3.0 mcg/kg (approximately 1/12 and 1/30 of the maximum recommended daily intranasal dose in adults and children on a mcg/m² basis, respectively).

No mutagenicity studies with triamcinolone acetonide have been performed.

In male and female rats, triamcinolone acetonide caused no change in pregnancy rate at oral doses up to 15.0 mcg/kg (approximately 1/2 of the maximum recommended daily intranasal dose in adults on [illegible] mcg/m² basis). Triamcinolone acetonide caused increased fetal resorptions and stillbirths and decreases in pup weight and survival at doses of 5.0 mcg/kg and above (approximately 1/5 of the maximum recommended daily intranasal dose in adults [illegible] mcg/m² basis). At 1.0 mcg/kg (approximately 1/30 of the maximum recommended daily intranasal dose [illegible] adults on a mcg/m² basis), it did not induce the above mentioned effects.

Pregnancy: *Teratogenic Effects: Pregnancy Category C.* Triamcinolone acetonide [illegible] teratogenic in rats, rabbits, and monkeys. In rats, triamcinolone acetonide was teratogenic at inhalation doses of 20 mcg/kg and above (approximately 7/10 of the maximum recommended daily intranasal dose in adults on a mcg/m² basis). In rabbits, triamcinolone acetonide was teratogenic [illegible] inhalation doses of 20 mcg/kg and above (approximately 2 times the maximum recommended daily intranasal dose in adults [illegible] mcg/m² basis). In monkeys, triamcinolone acetonide was teratogenic at an inhalation dose of 500 mcg/kg (approximately 37 times the maximum recommended daily intranasal dose in adults on [illegible] mcg/m² basis). Dose-related teratogenic effects in rats and rabbits included cleft palate and/or internal hydrocephaly and axial skeletal defects, whereas the effects observed in the monkey were cranial malformations.

There are no adequate and well-controlled studies in pregnant women. Therefore, triamcinolone acetonide should be used in pregnancy only if the potential benefit justifies the potential risk to the fetus. Since their introduction, experience with oral corticosteroids in pharmacologic as opposed to physiologic doses suggests that rodents are more prone to teratogenic effects from corticosteroids than humans. In addition, because there is a natural increase in glucocorticoid production during pregnancy, most women will require a lower exogenous corticosteroid dose and many will not need corticosteroid treatment during pregnancy.

Nonteratogenic Effects: Hypoadrenalism may occur in infants born of mothers receiving corticosteroids during pregnancy. Such infants should be carefully observed.

Nursing Mothers: It is not known whether triamcinolone acetonide is excreted in human milk. Because other corticosteroids are excreted in human milk, caution should be exercised when **Nasacort AQ** Nasal Spray is administered to nursing women.

Pediatric Use: Safety and effectiveness in pediatric patients below the age of 6 years have not been established.

Corticosteroids have been shown to [illegible] growth suppression in children and teenagers, particularly with higher doses over extended periods. If a child or teenag[illegible] on any corticosteroid appears to have growth suppression, the possibility that they [illegible] particularly sensitive to this effect of corticosteroids should be considered.

ADVERSE REACTIONS

In placebo-controlled, double-blind, and open-label clinical studies, 1483 adults and children 12 years and older received treatment with triamcinolone acetonide aqueous nasal spray. These patients were treated for an average duration of 51 days. In the controlled trials (2-5 weeks duration) from which the following adverse reaction data are derived, 1394 patients were treated with **Nasacort AQ** Nasal Spray for an average of 19 days. In [illegible] long-term, open-label study, 172 patients received treatment for an average duration of 286 days.

Adverse events occurring at an incidence of 2% or greater and more common among **Nasacort AQ**-treated patients than placebo-treated patients in controlled adult clinical trials were:

Adverse Events	Patients treated with 220 mcg triamcinolone acetonide (n=857) %	Vehicle Placebo (n=962) %
Pharyngitis	5.1	3.6
Epistaxis	2.7	0.8
Increase in cough	2.1	1.5

A total of 602 children 6 to 12 years of age were studied in 3 double-blind, placebo-controlled clinical trials. Of these, 172 received 110 mcg/day and 207 received 220 mcg/day of **Nasacort [illegible]** Nasal Spray for two, six, or twelve weeks. The longest average durations of treatment for patients receiving 110 mcg/day and 220 mcg/day were 76 days and [illegible] days, respectively. Only 1% of those patients treated with **Nasacort AQ** [illegible] discontinued due to adverse experiences. No patient receiving 110 mcg/day discontinued due to a serious adverse event and one patient receiving 220 mcg/day discontinued due to a serious event that was considered not drug related. Overall, these studies found the adverse experience profile for **Nasacort AQ** to be similar to placebo. A similar adverse event profile was observed in pediatric patients 6-12 years [illegible] age as compared to older children and adults with the exception of epistaxis which occurred in less than 2% of the pediatric patients studied.

Adverse events occurring at an incidence of 2% or greater and more common among adult patients treated with placebo than **Nasacort AQ** were: headache, and rhinitis. In children aged [illegible] to 12 years these events included: asthma, epistaxis, headache, infection, otitis media, sinusitis, and vomiting.

In clinical trials, nasal septum perforation was reported in one adult patient although relationship to **Nasacort AQ** Nasal Spray has not been established.

[illegible] the event of accidental overdose, an increased potential for these adverse experiences may be expected, but acute systemic adverse experiences are unlikely. (See **OVERDOSAGE**.)

OVERDOSAGE

Like any other nasally administered corticosteroid, acute overdosing is unlikely in view of the total amount of active ingredient present. In the event that the entire contents of the bottle [illegible] administered all at once, via either oral or nasal application, clinically significant systemic adverse events would most likely not result. The patient may experience some gastrointestinal upset.

Caution: Federal law prohibits dispensing without prescription.

Please see product circular for full prescribing information.

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NGS RESEARCH GRANT

Feats of Clay

Ancient Peruvian pottery factory yields clues to production of ceramics

BY BRIAN SHAFFIELD

Izumi Shimada, a National Geographic Society grantee, has studied the ancient cultures of Peru for almost 30 years. But at Huaca Sialupe, a site on Peru's northern coast, the archaeologist found something he'd never seen before: a factory. The pottery workshop of the Middle Sicán era is about a thousand years old, according to Shimada (left, at right). "This is the first time that a craft workshop of this time period has been extensively excavated and examined from a range of perspectives," he says. "Our study is producing a holistic understanding of pre-Hispanic craft production."

Among the objects found were a dozen small, specialized kilns, which once produced high-quality black pottery, as well as detailed decorative ceramics (above right) made by pressing clay into molds (above left).

The Middle Sicán craftsmen sought quality, not quantity. "Even though today we think of molds as geared to mass production and standardization, this workshop had more to do with simple reproduction of as wide a range of images as possible."

ENVIRONMENT

Weed-whacking Sheep

Test attacks kudzu infestation in Florida capital

MARK FOLEY, ASSOCIATED PRESS

Excoriated by John Muir as "hoofed locusts," sheep and their bottomless stomachs have been enlisted in Florida as conservation allies. The foe is the weed that won't go away: kudzu. Since arriving in the U.S. from Asia in 1876, kudzu has smothered native plants on millions of acres of the Southeast, and it is spreading north. Mowing is futile—kudzu can grow a foot a day—and herbicides can poison groundwater.

So Larry Schenk, city parks superintendent in Tallahassee, Florida, turned to sheep. "We've got 500 eating about an acre a day from 500 acres of parkland," he says. The sharp hooves of the sheep also damage the kudzu's massive root crowns. Resembling goats, the heat-tolerant sheep originated in the Caribbean and Africa. Schenk says the sheep love the kudzu: "They're gaining weight tremendously."

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good ideas are growing

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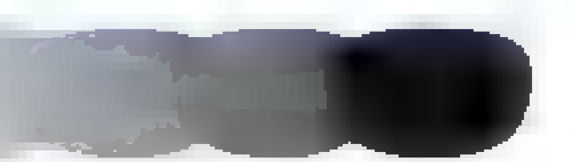

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RECORD OFFICE, LONDON

HISTORY

A New Old View of the Tower

Centuries-old Tower of London map found

Anna Keay, assistant curator at the Tower of London, had searched for a 1597 map of the Tower for years. A famous engraving had been made much later using this drawing, but the original hadn't been seen for centuries. Then Keay found a blurry photograph of the old map in an archaeology journal. The caption identified the image as the well-known engraving, but she knew it wasn't; there was too much detail. A visit to London's Public Record Office proved her hunch. There she found a previously unknown 1712 version (above), copied directly from the long-lost 1597 map. It provides valuable new information on Elizabethan architecture. And, she says, "If you lay it over a modern survey, it's incredibly accurate. The aerial view—as if someone hovered over the Thames in a helicopter in 1597—is amazing."

"ALONG WITH ALL THE GREAT MEMORIES HAS COME SOMETHING I THOUGHT I'D NEVER EXPERIENCE—THE PAIN OF OSTEOARTHRITIS."

—DOROTHY HAMILL

YOUR RESULTS MAY VARY.

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VIOXX IS HERE. 24-HOUR RELIEF OF THE MOST COMMON TYPE OF ARTHRITIS PAIN, OSTEOARTHRITIS.

It isn't about going for a medal. Or feeling like a kid again. It's about controlling the pain that can keep you from doing everyday things. And VIOXX may help. VIOXX is a prescription medicine for osteoarthritis, the most common type of arthritis.

ONE PILL—ALL DAY AND ALL NIGHT RELIEF.

You take VIOXX only once a day. Just one little pill can relieve your pain all day and all night for a full 24 hours.

VIOXX EFFECTIVELY REDUCED PAIN AND STIFFNESS.

In clinical studies, once-daily VIOXX effectively reduced pain and stiffness. So VIOXX can help make it easier for you to do the things you want to do. Like going for a morning glide on the ice.

TAKE WITH OR WITHOUT FOOD.

VIOXX doesn't need to be taken with food. So, you don't have to worry about scheduling VIOXX around meals.

IMPORTANT INFORMATION ABOUT VIOXX

People with allergic reactions, such as asthma, to aspirin or other arthritis medicines should not take VIOXX. In rare cases, serious stomach problems, such as bleeding, can occur without warning.

Tell your doctor if you have liver or kidney problems, or are pregnant. Also, VIOXX should not be used by women in late pregnancy.

VIOXX has been extensively studied in large clinical trials. Commonly reported side effects included upper respiratory infection, diarrhea, nausea and high blood pressure. Report any unusual symptoms to your doctor.

ASK YOUR DOCTOR OR HEALTHCARE PROFESSIONAL ABOUT VIOXX.

Call 1-800-MERCK-30 for more information, or visit **vioxx.com**. Please see important additional information on the next page.

9183904

Patient Information about
VIOXX® (rofecoxib tablets and oral suspension)
VIOXX® (pronounced "VI-ox")
for Osteoarthritis and Pain
Generic name: rofecoxib ("ro-fa-COX-ib")

You should read this information before you start taking VIOXX*. Also, read the leaflet each time you refill your prescription, in case any information has changed. This leaflet provides only ■ summary of certain information about VIOXX. Your doctor or pharmacist can give you ■ additional leaflet that is written for health professionals that contains more complete information. This leaflet does not take the place of careful discussions with your doctor. You and your doctor should discuss VIOXX when you start taking your medicine and at regular checkups.

What is VIOXX?

VIOXX is a nonsteroidal anti-inflammatory drug (NSAID) that is used to reduce pain and inflammation (swelling and soreness). VIOXX is available as a tablet or ■ liquid that you take by mouth.

VIOXX is a medicine for:

- relief of osteoarthritis (the arthritis caused by age-related "wear and tear" on bones and joints)
- management of acute pain in adults (like the short-term pain you can get after ■ dental or surgical operation)
- treatment of menstrual pain (pain during women's monthly periods).

Who should not take VIOXX?

Do not take VIOXX if you:

- have had an allergic reaction such as asthma attacks, hives, or swelling of the throat and face to aspirin or other NSAIDs (for example, ibuprofen and naproxen).
- have had an allergic reaction to rofecoxib, which is the active ingredient of VIOXX, or to any of its inactive ingredients. (See Inactive Ingredients at the end of this leaflet.)

What should I tell my doctor before and during treatment with VIOXX?

Tell your doctor if you are:

- pregnant or plan to become pregnant. VIOXX should not ■ used in late pregnancy because it may harm the fetus.
- breast-feeding ■ plan to breast-feed. It is not known whether VIOXX is passed through to human breast milk and what its effects could ■ on a nursing child.

Tell your doctor if you have:

- kidney disease
- liver disease
- heart failure
- high blood pressure
- had an allergic reaction to aspirin or other NSAIDs
- had a serious stomach problem in the past.

Tell your doctor about:

- any other medical problems or allergies you have now or have had.
- all medicines that you are taking or plan to take, ■ those you can get without a prescription.

Tell your doctor if you develop:

- ulcer or bleeding symptoms (for instance, stomach burning or black stools, which are signs of possible stomach bleeding).
- unexplained weight gain or swelling of the feet and/or legs.
- skin rash or allergic reactions. If you have a severe allergic reaction, get medical help right away.

How should I take VIOXX?

VIOXX should be taken once a day. Your doctor will decide what dose of VIOXX you should take and how long you should take it. You may take VIOXX with or without food.

Can I take VIOXX with other medicines?

Tell your doctor about all of the other medicines you are taking or plan to take while you are on VIOXX, even other medicines that you can get without a prescription. Your doctor may want to check that your medicines are working properly together if you are taking other medicines such as:

- methotrexate (a medicine used to suppress the immune system)
- warfarin (a blood thinner)
- rifampin (an antibiotic)
- ACE inhibitors (medicines used for high blood pressure and heart failure)
- lithium (a medicine used to treat a certain type of depression).

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What are the possible side effects of VIOXX?

Serious but rare side effects that have been reported in patients taking VIOXX and/or related medicines have included:

- Serious stomach problems, such as stomach and intestinal bleeding, can occur with or without warning symptoms. These problems, if severe, could lead to hospitalization or death. Although this happens rarely, you should watch for signs that you may have this serious side effect and tell your doctor right away.
- Serious allergic reactions including swelling of the face, lips, tongue, and/or throat which may cause difficulty breathing or swallowing and wheezing occur rarely but may require treatment right away. Severe skin reactions have also been reported.
- Serious kidney problems occur rarely, including acute kidney failure and worsening of chronic kidney failure.
- Severe liver problems, including hepatitis, jaundice and liver failure, occur rarely in patients taking NSAIDs, including VIOXX. Tell your doctor if you develop symptoms of liver problems. These include nausea, tiredness, itching, tenderness in the right upper abdomen, and flu-like symptoms.

■ addition, the following side effects have been reported: anxiety, confusion, depression, hair loss, hallucinations, increased levels of potassium in the blood, low blood cell counts, palpitations, pancreatitis, tingling sensation, unusual headache with stiff neck (aseptic meningitis), vertigo.

More common, but less serious side effects reported with VIOXX have included ■ following:

Upper and/or lower respiratory infection and/or inflammation
Headache
Dizziness
Diarrhea
Nausea and/or vomiting
Heartburn, stomach pain and upset
Swelling of the legs and/or feet
High blood pressure
Back pain
Tiredness
Urinary tract infection.

These side effects were reported in at least 2% of osteoarthritis patients receiving daily doses of VIOXX 12.5 mg to 25 mg in clinical studies.

The side effects described above do not include all of the side effects reported with VIOXX. Do not rely on this leaflet alone for information about side effects. Your doctor or pharmacist ■ discuss with you ■ more complete list of side effects. Any time you have a medical problem you think may be related to VIOXX, talk to your doctor.

What else can I do to help manage my osteoarthritis pain?

Talk to your doctor about:

- Exercise
- Controlling your weight
- Hot and cold treatments
- Using support devices.

What else should I know about VIOXX?

This leaflet provides ■ summary of certain information about VIOXX. If you have any questions ■ concerns about VIOXX, osteoarthritis or pain, talk to your health professional. Your pharmacist can give you an additional leaflet that is written for health professionals.

Do not share VIOXX with anyone else; it was prescribed only for you. It should be taken only for the condition for which it was prescribed.

Keep VIOXX and all medicines out of the reach of children.

Inactive Ingredients:

Oral suspension: citric acid (monohydrate), sodium citrate (dihydrate), sorbitol solution, strawberry flavor, xanthan gum, sodium methylparaben, sodium propylparaben.

Tablets: croscarmellose sodium, hydroxypropyl cellulose, lactose, magnesium stearate, microcrystalline cellulose, and yellow ferric oxide.

Issued July 2001

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Behind the Scenes

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A Story Hits Home

D-Day: a tale of love, war, and surprises

When Constance Phelps, our Senior Editor for Design, read frequent contributor Tom Allen's proposal for this issue's D-Day article, she was stunned: One of the lost ships Tom hoped to write about was the U.S.S. *Corry* (inset), a destroyer commanded by Connie's father, Lt. Comdr. George Dewey Hoffman.

"I got so excited," Connie says. "Tom had no clue my father had a role in D-Day."

The *Corry*—a lead destroyer in the attack on Utah Beach—sank in eight minutes after striking an underwater mine while maneuvering to avoid German fire. Two dozen men lost their lives, but more than two hundred other crewmen survived, including Hoffman, the last man to leave the sinking vessel.

Connie and her husband, David, recently honored the lost men and their ship by tossing a wreath of carnations over the site where it went down (above). "It was very emotional standing right over where the *Corry* sank," she says. "I felt as if I could almost reach out and touch it."

Hoffman, who later commanded other ships, including another destroyer, was married six months before D-Day (left). His wife, Lois, a naval communications officer in Norfolk, Virginia, was unaware of his role in the invasion until he sent her a cable after he was rescued. It read simply: "I am well."

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ANTHONY STEWART [illegible] RIGHT), [illegible] DISNEY ENTERPRISES, INC.

No Mickey Mouse Artist

Donald's illustrator looked to the GEOGRAPHIC

Did Donald Duck read the GEOGRAPHIC? No. But to Carl Barks, who drew the popular Donald Duck comics from 1942 to 1966, our magazine was a major source of inspiration and information.

"Without question, NATIONAL GEOGRAPHIC was the single favorite source for the duck stories," says Bruce Hamilton, Barks's friend and publisher of a massive 30-volume collection of the artist's work, *The Carl Barks Library*. Barks, who died at the age of 99 in August 2000, admitted that he used to "rob" us. "It was my best reference," he told a 1983 interviewer. "If I didn't have something like the GEOGRAPHIC, I wouldn't have any means of making things realistic."

Scholars of the Donald Duck oeuvre have found that Barks used the magazine in more than a dozen comic stories, in settings from ancient Persia to the Everglades, from the Andes to pirate ships at sea. He based Dismal Downs, the ancestral home of the Duck clan, on photos in a 1947 article about British castles. And in these panels from 1943's "The Mummy's Ring" (above), he adapted photographs of the Colossi of Memnon (top) and the Step Pyramid of Djoser, among others, as backgrounds for a Duck family adventure. "Using the GEOGRAPHIC gave his stories tremendous authenticity," Hamilton says. "He wore it as a badge of honor."

Photographed by W. Scott McGraw

WILDLIFE AS CANON SEES IT

Raucous behavior, noisy vocalizing and a brilliant pelage make the Diana monkey a conspicuous presence in the forest canopy. When the family group forages for fruits and insects, the dispersed members stay in frequent contact, communicating with body postures and a variety of calls—ranging from trills and chirps to deep reverberating roars. Diana monkeys are so adept at detecting potential predators such as chimpanzees and leopards that other monkey species often stay nearby to use them as warning sentinels. The Diana monkey needs undisturbed primary forest to sustain itself, but only islands of forest remain in West Africa.

As a global corporation committed to social and environmental concerns, we join in worldwide efforts to promote greater awareness of endangered species for the benefit of future generations.

Diana Monkey *(Cercopithecus diana)*
Size: Head and body length, 40-60 cm; tail, 52-82 cm
Weight: Female, 2.2-3.5 kg; male, 3.5-7.5 kg
Habitat: Primary rainforest from Sierra Leone to Ghana, West Africa
Surviving number: Unknown; populations declining

© 2002 Canon Inc.

KAREN KASMAUSKI

In Praise of the Female Athlete

Photographer Karen Kasmauski's image of synchronized swimmers rehearsing in Laguna Hills, California, is one of many by NATIONAL GEOGRAPHIC photographers featured in "Game Face: What Does a Female Athlete Look Like?" The exhibit of 182 photographs hails girls and women in an effort to show how participation in sports has shaped their identities. Included are athletes famous and little known, ranging from a corseted 1890s bicycle rider to a shirtless Brandi Chastain celebrating the 1999 World Cup victory of the U.S. women's soccer team.

The exhibit, which opened at the Smithsonian Institution in Washington, D.C., in June 2001 and appeared at the Winter Olympics in Salt Lake City, runs through the end of next month at the Women's Museum in Dallas, Texas.

A Landmark Grant

Tyrone Hayes has been interested in amphibians and Africa since he was a child. "Both came mostly from reading the GEOGRAPHIC," he recalls. So it was a thrill for Tyrone, now a University of California, Berkeley, biologist, to get funding from our Committee for Research and Exploration to study African frogs. His latest grant, to investigate hormonal changes in reed frogs near Lake Victoria, carried extra import: It was the committee's 7,000th in a history spanning more than a century.

PRECISION IMAGE PRODUCTIONS

Tyrone is attempting to learn why some frogs in the genus *Hyperolius* change color when they reach maturity and are able to reproduce, and why the coloring of males is different from that of females. He sometimes stows the frogs he collects in bags under his shirt (left) to keep them out of the sun.

FOR MORE INFORMATION

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What happens if you don't talk to your doctor about VIAGRA?

Nothing.

When it comes to erection difficulties, such as erectile dysfunction (ED), too many men give their doctors the silent treatment.

But ED is a health condition. It can be linked to things like high blood pressure, high cholesterol, and stress, so doctors are trained to discuss it. In fact, doctors have already prescribed VIAGRA to **more than 9 million men.** Because doctors know that VIAGRA works for most men, no matter what's causing their ED.

So instead of making excuses, make an appointment with your doctor. For more information, call 1-888-4VIAGRA or visit www.viagra.com.

Join the millions. Ask your doctor if a free sample is right for you.

VIAGRA is indicated for the treatment of erectile dysfunction. Remember that no medicine is for everyone. If you use nitrate drugs, often used to control chest pain (also known as angina), don't take VIAGRA. This combination could cause your blood pressure to drop to an unsafe or life-threatening level.

Discuss your general health status with your doctor to ensure that you are healthy enough to engage in sexual activity. If you experience chest pain, nausea, or any other discomforts during sex or an erection that lasts longer than 4 hours, seek immediate medical help. The most common side effects of VIAGRA are headache, facial flushing, and upset stomach. Less commonly, bluish vision, blurred vision, or sensitivity to light may briefly occur.

Please see patient summary of information for VIAGRA (25-mg, 50-mg, 100-mg) tablets on the following page.

J o i n   t h e   m i l l i o n s .

PATIENT SUMMARY OF INFORMATION ABOUT

This summary contains important information about VIAGRA®. It is not meant [illegible] take the place of your doctor's instructions. Read this information carefully before you start taking VIAGRA. Ask your doctor or pharmacist if you do not understand any of this information or if you want to know more about VIAGRA.

This medicine can help many men when it is used [illegible] prescribed by their doctors However, VIAGRA is not for everyone. It is intended for use only by men who have a condition called erectile dysfunction. **VIAGRA must never be used by men who are taking medicines that contain nitrates of any kind, at any time. This includes nitroglycerin. If you take [illegible] with any nitrate medicine your blood pressure could suddenly drop to an unsafe [illegible] life threatening level.**

[illegible] Is [illegible]

VIAGRA is [illegible] pill used to treat erectile dysfunction (impotence) in men. It can help many men who have erectile dysfunction get and keep an erection when they become sexually excited (stimulated).

You will not get an erection just by taking this medicine. VIAGRA helps a man with erectile dysfunction get [illegible] erection only when he is sexually excited.

How Sex Affects the Body

When a [illegible] is sexually excited, the penis rapidly fills with more blood than usual. The penis then expands and hardens. This is called an erection. After the man is done having sex, this extra blood flows out of the penis back into the body. The erection goes away. If an erection lasts for [illegible] long time (more than 6 hours), [illegible] can permanently damage your penis. You should call a doctor immediately if you ever have a prolonged erection that lasts [illegible] than 4 hours.

Some conditions and medicines interfere with this natural erection process. The penis cannot fill with enough blood. The man cannot have an erection. This is called erectile dysfunction if it becomes a frequent problem.

During sex, your heart works harder. Therefore sexual activity may not [illegible] advisable for people who have heart problems. Before you start any treatment for erectile dysfunction, ask your doctor if your heart is healthy enough to handle the extra strain of having sex. If you have chest pains, dizziness or [illegible] during sex, stop having sex and immediately tell your doctor you have [illegible] this problem.

How [illegible] [illegible]

VIAGRA enables many men with erectile dysfunction to respond to sexual stimulation. When a man is sexually excited, VIAGRA helps the penis fill with enough blood to cause an erection. After [illegible] is over, the erection goes away.

[illegible] Is Not for Everyone

As noted above (*How Sex Affects the Body*), ask your doctor if your heart is healthy enough for sexual activity.

If you take any medicines that contain nitrates–either regularly or as needed–you should never take VIAGRA. If you take VIAGRA with any nitrate medicine [illegible] recreational drug containing nitrates, your blood pressure could suddenly drop to an unsafe level. You could get dizzy, faint, or even have a heart attack or stroke. Nitrates are found in many prescription medicines that are used [illegible] [illegible] angina (chest pain due to heart disease) such as:

- nitroglycerin (sprays, ointments, skin patches or pastes, and tablets that are swallowed or dissolved in the mouth)
- isosorbide mononitrate and isosorbide dinitrate (tablets that are swallowed, chewed, or dissolved in the mouth)

Nitrates are also found in recreational drugs such [illegible] amyl nitrate or nitrite ("poppers") If you are not sure if any of your medicines contain nitrates, or if you [illegible] not understand what nitrates are, ask your doctor or pharmacist

VIAGRA is only for patients with erectile dysfunction. VIAGRA is not for newborns, children, or women. Do not let anyone else take your VIAGRA. VIAGRA must be used only under a doctor's supervision.

What [illegible] [illegible] [illegible] Do

- VIAGRA does not cure erectile dysfunction. It is a treatment [illegible] erectile dysfunction.
- VIAGRA does not protect you or your partner from getting sexually transmitted diseases, including HIV–the virus that causes AIDS
- VIAGRA is not a hormone or an aphrodisiac.

What To Tell Your Doctor [illegible] You Begin [illegible]

Only your doctor can decide if VIAGRA is right for you. VIAGRA [illegible] [illegible] mild, temporary lowering of your blood pressure. You will [illegible] to have a thorough medical exam to diagnose your erectile dysfunction and [illegible] find out if you can safely take VIAGRA alone [illegible] with your other medicines. Your doctor should determine if your heart is healthy enough to handle the extra strain of having [illegible].

Be sure to tell your doctor if you:

- have ever had any heart problems (e.g., angina, chest pain, heart failure, irregular heart beats, or heart attack)
- have ever had a stroke
- have low or high blood pressure
- have a rare inherited eye disease called retinitis pigmentosa
- have ever had any kidney problems
- have ever had any liver problems
- have ever had any blood problems, including sickle cell anemia or leukemia
- are allergic to sildenafil or any of the other ingredients of VIAGRA tablets
- have a deformed penis, Peyronie's disease, or ever had an erection that lasted more than [illegible] hours
- have stomach ulcers or any types of bleeding problems
- are taking any other medicines

[illegible] [illegible] Other Medicines

Some medicines can change the way VIAGRA works. Tell your doctor about **any medicines** you are taking. Do not start or stop taking any medicines before checking with your doctor or pharmacist. This includes prescription and nonprescription medicines [illegible] remedies. Remember, VIAGRA should never be used with medicines that contain nitrates (see *VIAGRA Is Not for Everyone*). If you are taking a protease inhibitor, your dose may be adjusted (please [illegible] *Finding the Right Dose for You.*) VIAGRA should not be used with any other medical treatments that cause erections. These treatments include pills, medicines that are injected or inserted into the penis, implants or vacuum pumps.

Finding the Right Dose for You

VIAGRA comes in different doses (25 mg, 50 mg and 100 mg). If you do not get the results you expect, talk with your doctor. You and your doctor can determine the dose that works best for you.

- Do not take more VIAGRA than your doctor prescribes.
- If you think you need a larger dose of VIAGRA, check with your doctor.
- VIAGRA should not be taken more than once a day.

If you are older than age 65, or have serious liver or kidney problems, your doctor may start you at the lowest dose (25 mg) of VIAGRA. If you are taking protease inhibitors, such as for the treatment of HIV, your doctor may recommend a 25 mg dose and may limit you to a maximum single dose of 25 mg of VIAGRA in [illegible] 48 hour period.

How To [illegible] [illegible]

Take VIAGRA [illegible] one hour before you plan to have sex. Beginning in about 30 minutes and for up [illegible] 4 hours, VIAGRA can help you get an erection if you are sexually excited. If you take VIAGRA after a high-fat meal (such as a cheeseburger and french fries), the medicine may take a little longer [illegible] start working. VIAGRA can help you get an erection when you are sexually excited. You will not get an erection just by taking the pill.

Possible [illegible] Effects

Like all medicines, VIAGRA [illegible] cause some side effects. These effects are usually mild to moderate and usually don't last longer than [illegible] few hours. Some of these side effects are more likely [illegible] occur with higher doses. The most common side effects of VIAGRA are headache, flushing of the face, and upset stomach. Less common side effects that may [illegible] [illegible] temporary changes in color vision (such as trouble telling the difference between blue and green objects or having a blue color tinge to them), eyes being more sensitive [illegible] light, or blurred vision.

In rare instances, men have reported [illegible] erection that lasts many hours. You should call a doctor immediately if you ever have an erection that lasts more than 4 hours. If not treated right away, permanent damage to your penis could occur (see *How Sex Affects the Body*).

Heart attack, stroke, irregular heart beats, and death have been reported rarely in men taking VIAGRA. Most, but not all, of these [illegible] had heart problems before taking this medicine. It is not possible to determine whether these events were directly related to VIAGRA.

VIAGRA may cause other side effects besides those listed on this sheet. [illegible] you want more information or develop any side effects or symptoms you are concerned about, call your doctor.

Accidental [illegible]

In [illegible] of accidental overdose, call your doctor right away.

Storing [illegible]

Keep VIAGRA out of the reach of children. Keep VIAGRA in its original container. Store at room temperature, 59°-86°F (15°-30°C)

For More Information on VIAGRA

VIAGRA is [illegible] prescription medicine used to treat erectile dysfunction. Only your doctor can decide if it is right for you. This [illegible] is only a summary. If you have any questions or want more information about VIAGRA, talk with your doctor or pharmacist, visit www.viagra.com, or call 1-888-4VIAGRA.

23-5515-00-4 June 1999

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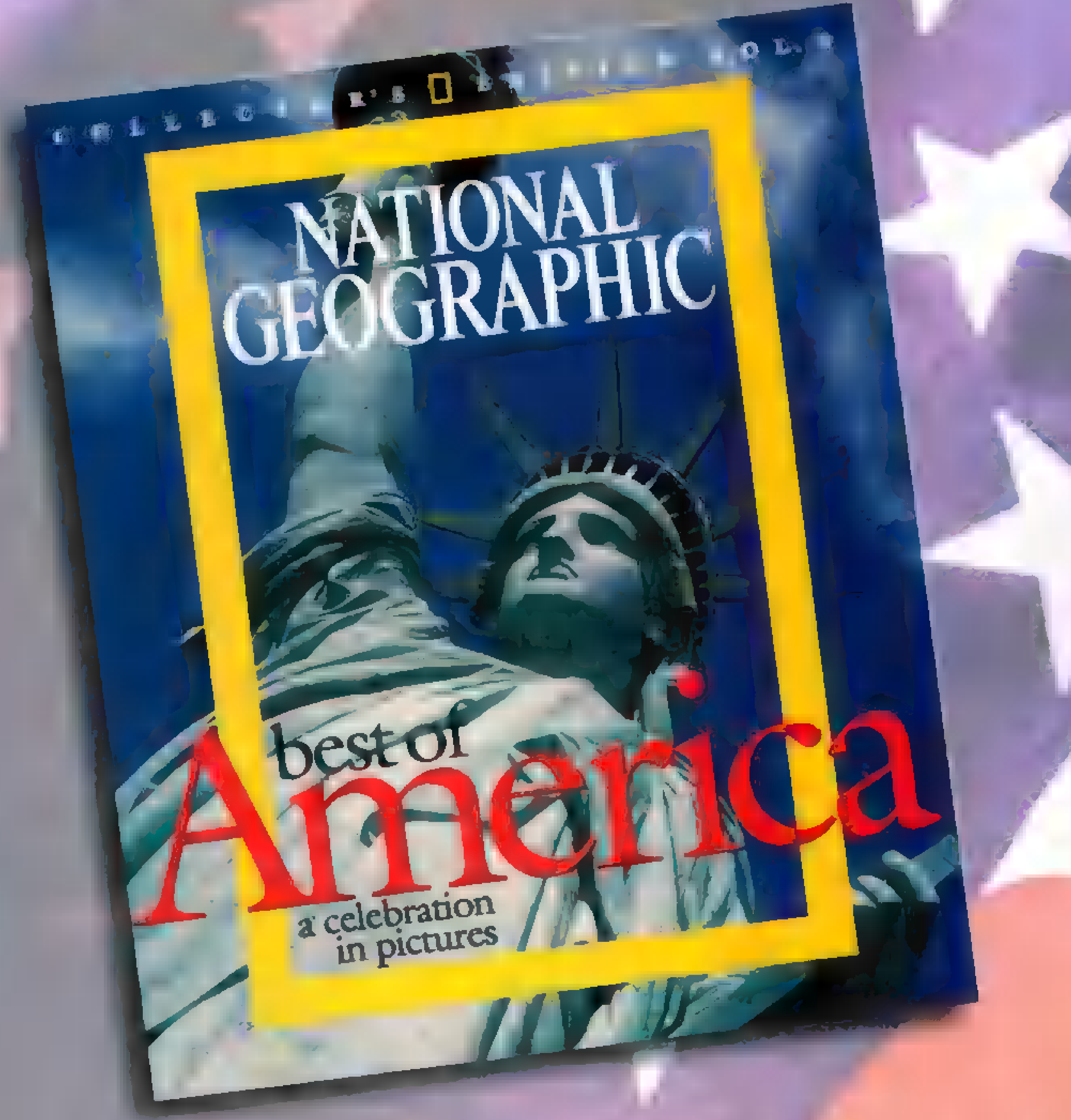

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BOB SACHA

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Create your own maps at *nationalgeographic.com/mapmachine*

D-Day Memories

Two WWII veterans join thousands of others remembering D-Day at the dedication of the National D-Day Memorial in Bedford, Virginia. Step back in history with them and hear veterans' personal stories, scan a portfolio of images, post your thoughts in our Memory Book, and get information on how to travel to Bedford at [illegible]

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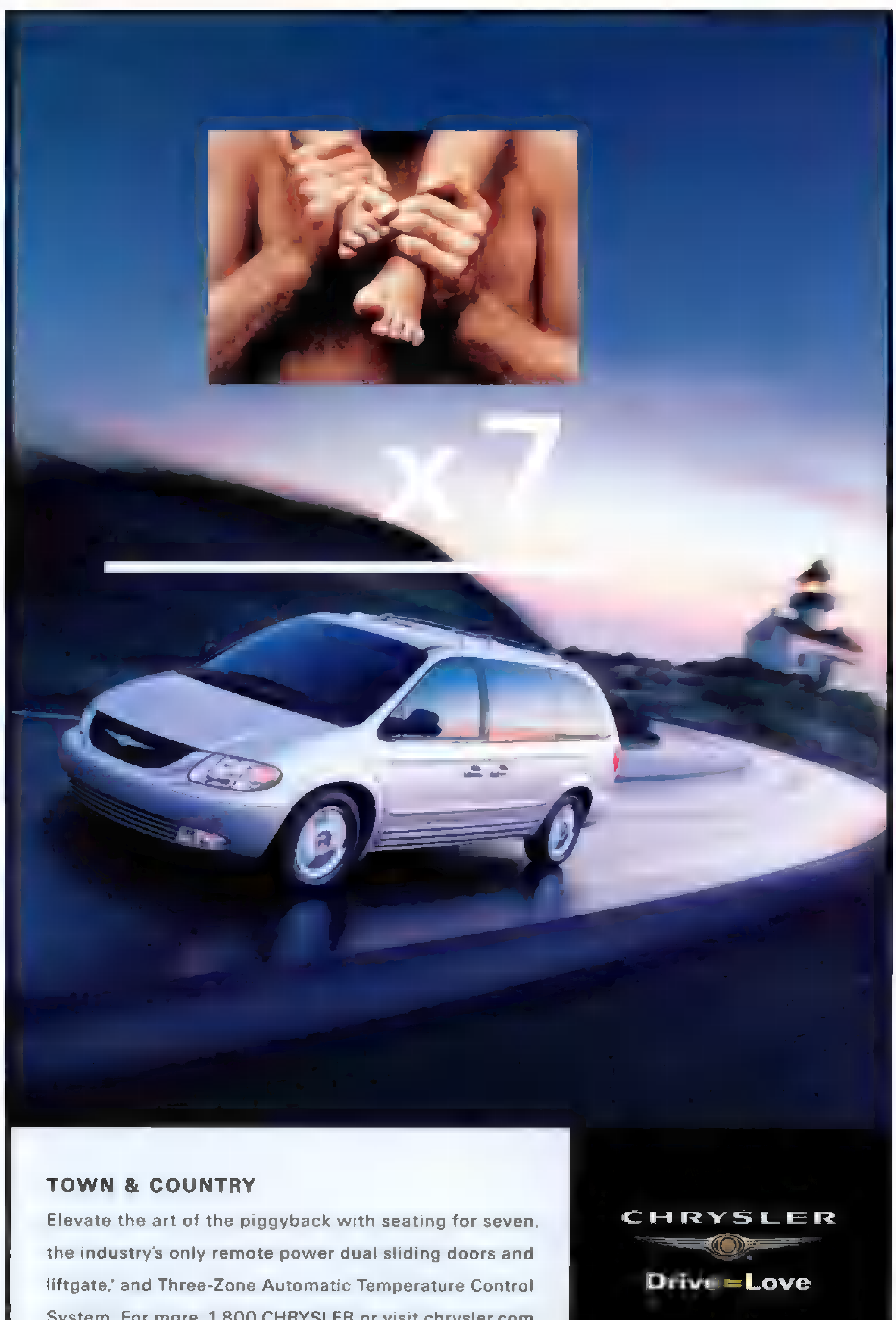

*Available on select Town & Country models.

National Geographic TV

NATIONAL GEOGRAPHIC CHANNEL

Fallen Hero

Colombia's [illegible] civil war isn't the only tragedy facing the children of Cali. *World Diaries* profiles people in Colombia struggling to make a difference in children's lives. One of those people, Hector Fabio, tells how he created a circus school for street children. Late last year Fabio died, leaving the children with one less hero and a show that must still go on.

[illegible] FINE

NATIONAL GEOGRAPHIC EXPLORER, MSNBC

Labor of Love

ED GEORGE

"Conservation is about education," says EXPLORER field specialist Mireya Mayor, holding a highly endangered lemur in Madagascar. "Get people to care about what you love, and half your work is done," she says. Mayor's résumé ranges from NFL cheerleader to Fulbright scholar to primatologist. The conservationist's research will be the subject of future EXPLORER specials.

National Geographic EXPLORER MSNBC, Sundays, 8 p.m. ET/5 p.m. PT. **National Geographic Specials** PBS. See local listings. **National Geographic Videos, Kids Videos, and DVDs** Call 1-800-627-5162. **National Geographic Channel** Call your cable or satellite provider.

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Ask Us

THE ANSWER PLACE

[illegible] Research Correspondence staff [illegible] to [illegible] from curious readers.

Q Is [illegible] safe to assume that the larger [illegible] mammal, the longer its gestation period?

A Generally. The typical gestation period for an elephant is 22 months, compared with 19 days for a house mouse. On the other hand, marsupials, which are born tiny and undeveloped, have relatively short pregnancies: 13 days for a Virginia opossum, 33 for a red kangaroo.

Q What was the Western Hemisphere's first major city?

A Certainly a contender would be Teotihuacan, now a massive archaeological site in present-day Mexico. Arguably the hemisphere's first true urban center, the well-ordered metropolis, replete with palaces, monuments, and pyramids, arose around the beginning of the Christian era. Covering nearly eight square miles, it was laid out in alignment with nearby mountains and the movement of stars. At the center of a vast trading network, Teotihuacan attracted immigrants from great distances. The city held perhaps 200,000 people at the height of its prosperity, about A.D. 500, rivaling London a millennium later.

Q Where does the word "dollar" come from?

A In the 1500s Count Hieronymus Schlick of Bohemia began minting coins known [illegible] Joachimstalers, named for Joachimstal, the valley where the silver was mined. Joachimstaler was later shortened to taler, [illegible] word that eventually found its way into Danish and Swedish as daler, Dutch as daalder, Ethiopian as talari, Italian as tallero, Flemish as daelder, and English as dollar.

Q In 1492, what was the population of the land that now constitutes the contiguous United States?

A Anthropologists and other scholars hotly debate this question and offer a wide range of estimates. One conservative calculation is 800,000 people, with another 200,000 in what is now Canada. The native population reached its greatest density on the Pacific coast.

[illegible]

Send questions to **Ask Us, National Geographic Magazine, PO Box 98199, Washington, DC 20090-8199** or via the Internet to **ngsaskus@nationalgeographic.com**. Include name, address, and daytime phone number.

[illegible]

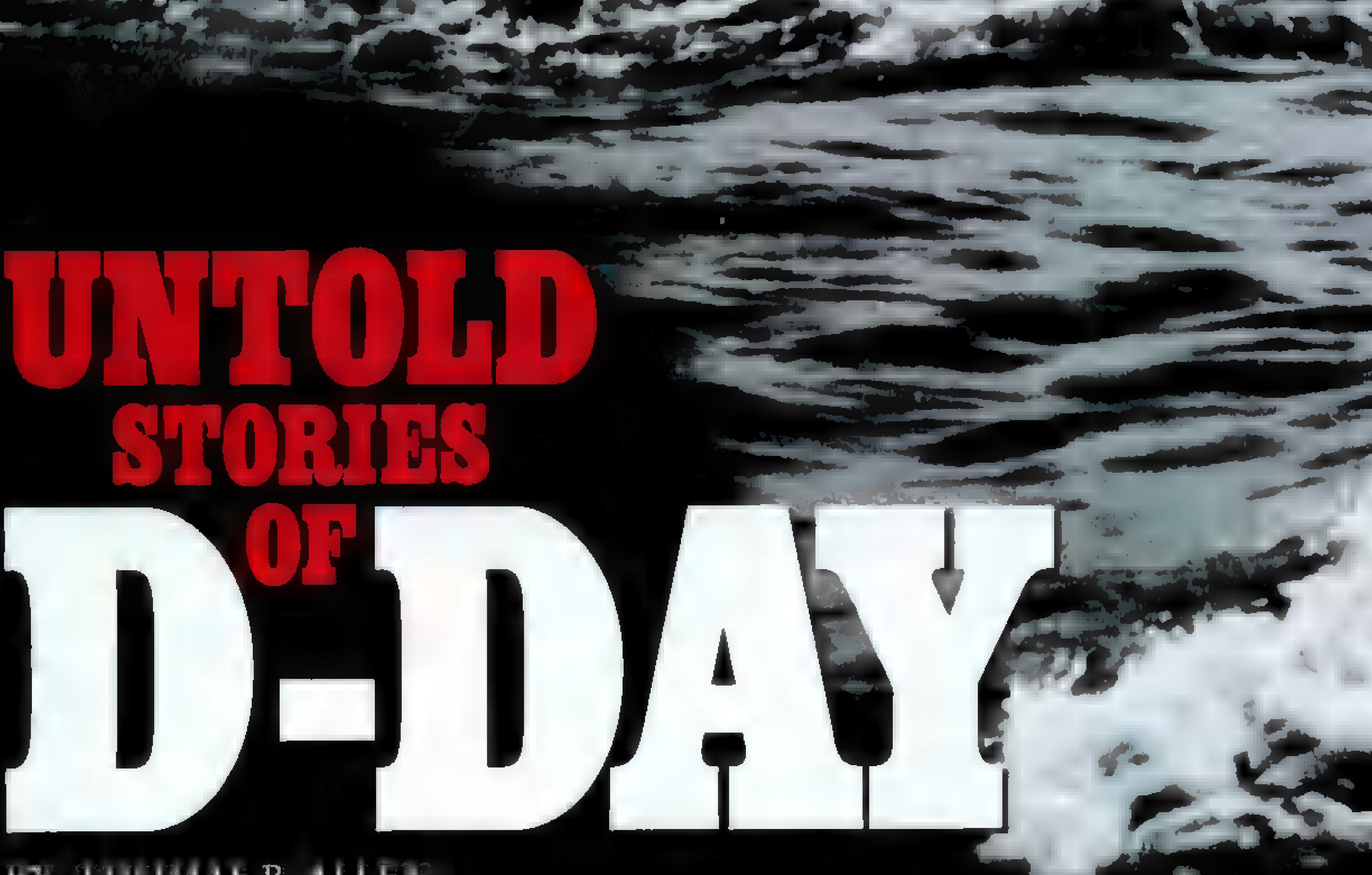
What made these lobsters blush?

Think you know the [illegible]? Go online to nationalgeographic.com/ngm/tellus/0206 and test yourself, or read [illegible] here [illegible] next month's issue.

May answer The tree [illegible] aflame with fireflies. About 2,000 species of the bioluminescent beetles light up night skies on every continent except Antarctica.

PETER ESSICK, AURORA/PICTUREQUEST

JUNE 6 DAWNS, and D-Day once more returns to Normandy. The tide is low at Utah Beach and Omaha Beach, as it was then. The sand hardens underfoot, as it did then. I touch a rusted metal stump thrusting from the sand, a remnant of the rows of barriers that lined this shore on June 6, 1944. Clouds crowd the sky this morning. It will be a gray day, as it was then.



UNTOLD STORIES OF D-DAY

BY THOMAS B. ALLEN

FIVE NORMANDY BEACHES were stormed on D-Day by British, Canadian, and American troops. Every beach holds grim memories for survivors, but the two American beaches—Utah and Omaha—are the focus of this story. On the shore later known as Bloody Omaha (below), German guns mowed down men as they struggled through the surf. One Navy doctor working in "pink murky water" could not "distinguish the living from the dead."

NATIONAL ARCHIVES

To this shore every June come clusters of silent men who walk with their kin and their memories. One of them is Joseph Vaghi, a warm, vigorous Navy veteran who was a beachmaster on D-Day—"a kind of traffic cop," he says—at a bloody stretch of Omaha Beach code-named Easy Red sector.

I met Vaghi on the wind-scoured bluffs overlooking those gray sands, now so empty and calm. Nearby was the American cemetery with its 9,387 graves, 23 of them carrying the names of men from Joe's outfit, the Sixth Naval Beach Battalion. Its men disabled mines, marked sea-lanes

for landing craft, cared for the beachhead wounded under fire, and bore them through a reddening sea to evacuation craft. The day I met him, Vaghi was helping to dedicate a belated memorial to his fallen comrades. So humble was their outfit, he laughed, that the United States armed forces—even the Navy—forgot about them for nearly 60 years.

Atop a cliff that courage conquered, American veterans and French flowers honor the U.S. Army Rangers of D-Day. They scaled the 100-foot crag of Pointe du Hoc to destroy long-range German guns thought to be aimed at troops approaching Omaha and Utah Beaches. The Germans had removed the guns but stood ready to fight. Of the 250 Rangers who landed, only 90 could still bear arms when the battle ended in victory two days later.

ALEXANDRA BOULAT

It was to meet men like Joe Vaghi, and to hear their stories, that I came to Normandy last summer. I was searching for the untold saga of D-Day, those fascinating bits of history and heroism that have gone largely unreported in the decades since that terrible morning on the beach. Many of these stories were lost because the sea closed over them, sealing lips forever. Others were obscured by the shroud of secrecy that was draped over many aspects of the invasion, including the Allies' Operation Neptune—the top secret naval and amphibious actions, under British command, that launched and supported the invasion.

As he and I talked, the U.S. Navy was again off the beaches of Normandy, this time to scan the seafloor. Using sonar, magnetometers, and the global positioning system, Navy archaeologists were filling in the gaps of history by locating the vessels lost while delivering the U.S., British, and Canadian troops who stormed the beaches and fought their way inland. Of the 5,300 ships, boats, and amphibious craft that took part in the invasion, at least 200 were lost on D-Day or during the perilous days that followed.

To piece together the full story, historians are now sifting through evidence ranging from recently declassified documents to underwater photos of the wrecks (pages 10-13). What has emerged are secrets that men and women once guarded with their lives, adding detail and color to the story of D-Day. One of the darkest subplots of all, I found, came from the English side of the Channel.

FOR JOE VAGHI and tens of thousands of other Americans stationed in England in the spring of 1944, France was the Far Shore, the place where they would finally meet the Nazis in a fight to the death. To prepare, they trained along a stretch of English coast that had been cleared of civilians. It was called Slapton Sands, a tranquil beach that was chosen for its geographic similarity to the coast of Normandy. Their most realistic training was Exercise Tiger, a live-ammunition D-Day rehearsal that involved some 300 ships and 30,000 men in April 1944, six weeks before the invasion.

Gen. Dwight D. Eisenhower, supreme commander of Operation Overlord (Allied code for the invasion itself), was aboard an observers' ship on April 27, when Exercise Tiger went terribly wrong—failed air cover, late landing craft, confusion on the beachhead. Amphibious tanks, heading to shore, misaimed their guns and wounded soldiers on the beach. At least one of the tanks sank in choppy seas while its frantic crew managed to escape. Furious, Eisenhower returned to his headquarters, deeply worried about

Relic of D-Day, the flag of the U.S.S. *Corry* survives though the destroyer no longer exists. Sunk by a mine while firing on German shore guns, the *Corry* became a tomb for at least five crewmen (page 13). Postwar souvenir hunters looted the hulk. Salvage crews later blew up and hauled away what was left.

NATIONAL GEOGRAPHIC PHOTOGRAPHER MARK THIESSEN; COLLECTION OF [illegible]

what the exercise augured for D-Day.

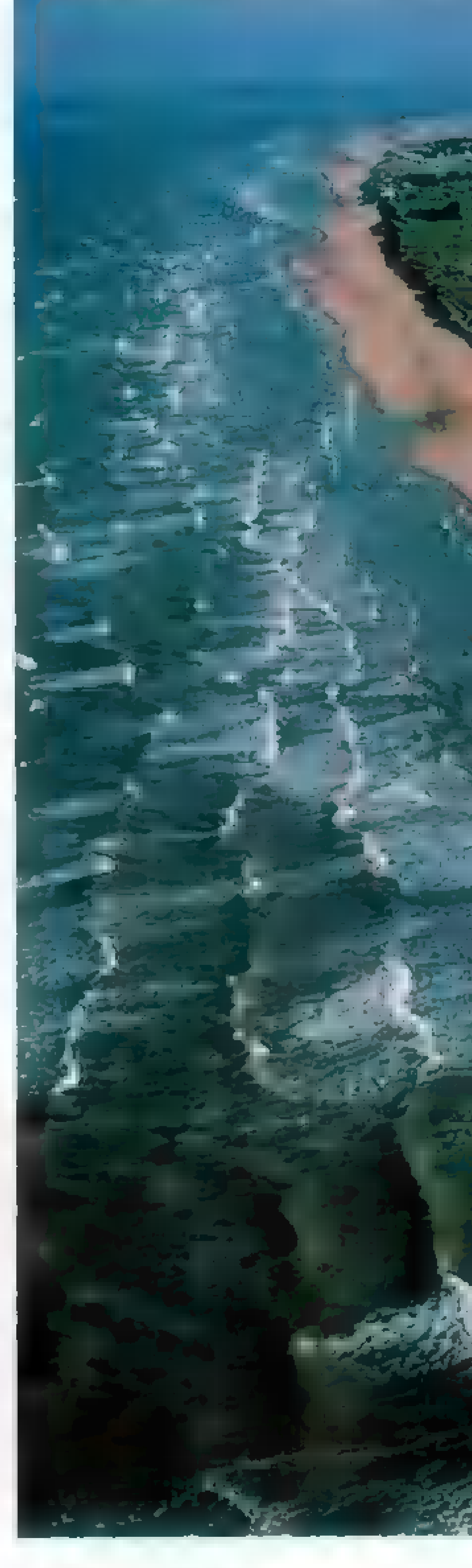
Worse was yet to come. Around 2 a.m. on April 28, nine German *Schnellboote*—fast, elusive torpedo boats—pounced on a line of eight U.S. tank-landing ships, or LSTs. They were churning down the English coast toward Slapton Sands, fully loaded with vehicles and men who were to land in the next phase of Exercise Tiger. German torpedoes struck three LSTs at the end of the line. *LST-531* capsized and sank within minutes, taking hundreds of men down with her. The torpedo that hit *LST-289* crumpled her stern, but she stayed afloat and made it to port. Gasoline aboard *LST-507* exploded and set the ship afire.

Eugene Eckstam, a medical officer on the *507*, raced for the tank deck, which was filled with men and vehicles. "I saw only fire—a huge, roaring blast furnace," he later wrote. "Trucks were burning; gasoline was burning; and small-arms ammunition was exploding. Worst of all were the agonizing screams for help from the men trapped inside. . . . But I knew there was no way I—or anyone else—could help them. I knew also that smoke inhalation would soon end their misery, so I closed the hatches into the tank deck and dogged them tightly shut."

Senior officers ashore, quickly assessing the damage, ordered the five surviving LSTs to continue steaming toward Dartmouth, their destination. Capt. John Doyle, commanding officer of *LST-515*, the lead ship, disobeyed the order. He turned back to look for survivors. "We started looking for the ones who were still alive," Brent Wahlberg, *515* gunnery officer, remembers. "We found 132 survivors." Many of the dead, they noticed, were floating head down, feet up, with their life belts inflated. No one had told them that the life belts were to be worn under the armpits, not around the waist. That lesson from Exercise Tiger would be taught to invasion troops, saving countless lives.

In the meantime, Eisenhower had an intelligence nightmare on his hands. To keep the disaster a secret, he ordered extraordinary measures and kept the lid so tight that the details remained unknown for many years. He did not want Germany or Allied troops to know about the huge loss of life—749 sailors and soldiers by final count. Of even greater concern was the possibility that the Schnellboote might have picked up survivors who carried the most closely guarded secret of the war in their pockets—the location of the D-Day landing.

The broad sands of Utah Beach lead to a countryside scarred by remains of German fortifications. D-Day landing craft, pushed off course by strong tides, dropped U.S. troops [illegible] Utah sites that were—luckily—weakly defended. Germans flooded low fields behind the beach dunes, but that merely slowed down the Americans. By late afternoon they had fought their way inland, connecting with paratroopers of the 82nd Airborne, who had reached points along the road that paralleled the shore. In 15 hours [illegible] than 20,000 troops and 1,700 vehicles went ashore at Utah.



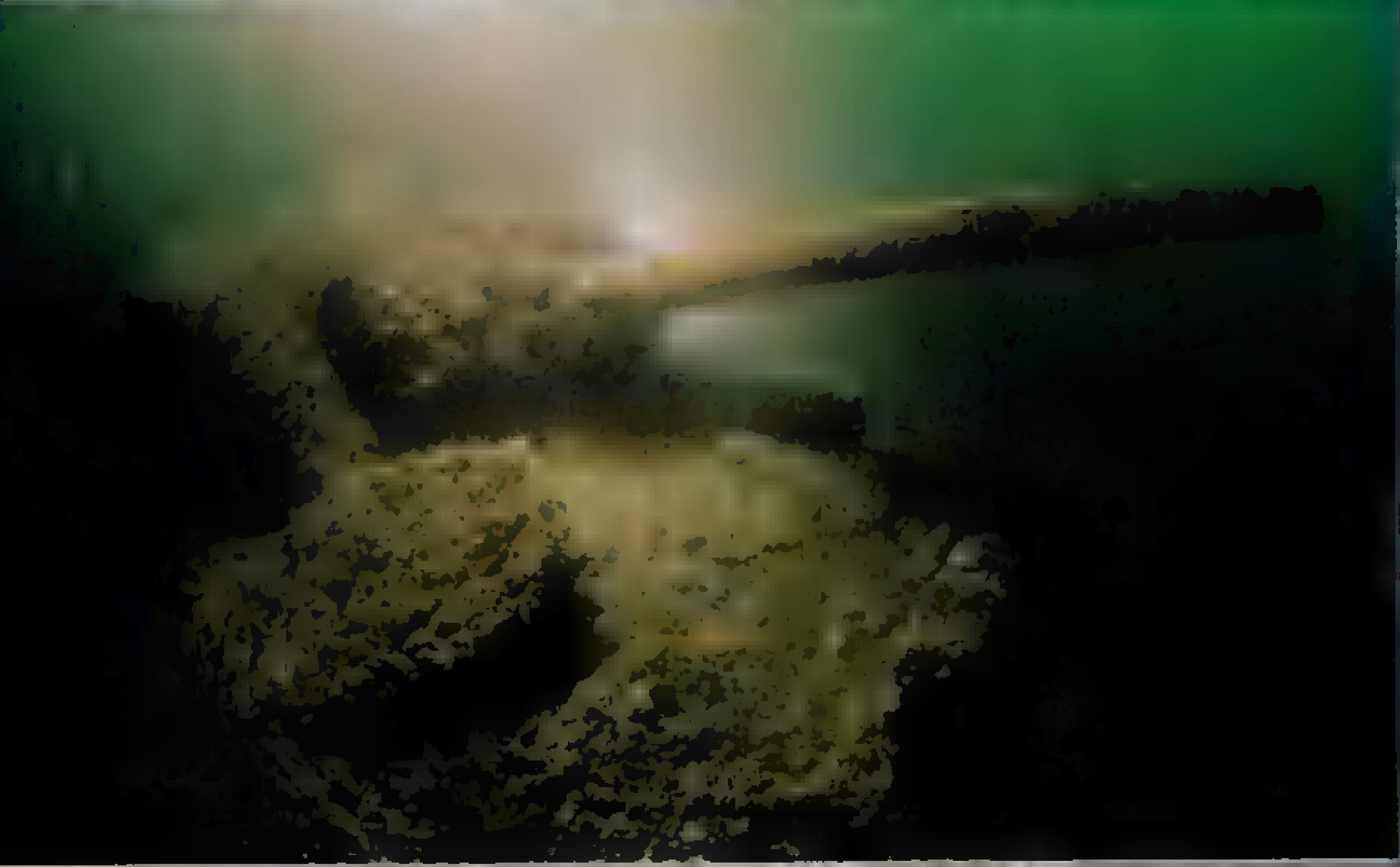
One simple word, BIGOT, is stamped in big letters across the Operation Neptune Initial Joint Plan of February 12, 1944, and from then until June 6, that stamp appeared on all supremely secret pieces of paper handled by D-Day planners. If any of those papers or maps had fallen into

ALEXANDRA BOULAT (ALL)

D-Day weaponry surrounds Jacques Lemonchois, who runs the Museum of Invasion Shipwrecks in Port-en-Bessin. Hired to clear harbors clogged by war, he made some 3,000 dives off the invasion beaches and "decided to keep a few things"— from helmets to tanks. Another museum, at Utah Beach, displays the dog tag (facing page) of a sailor who survived the sinking of the *Corry*.

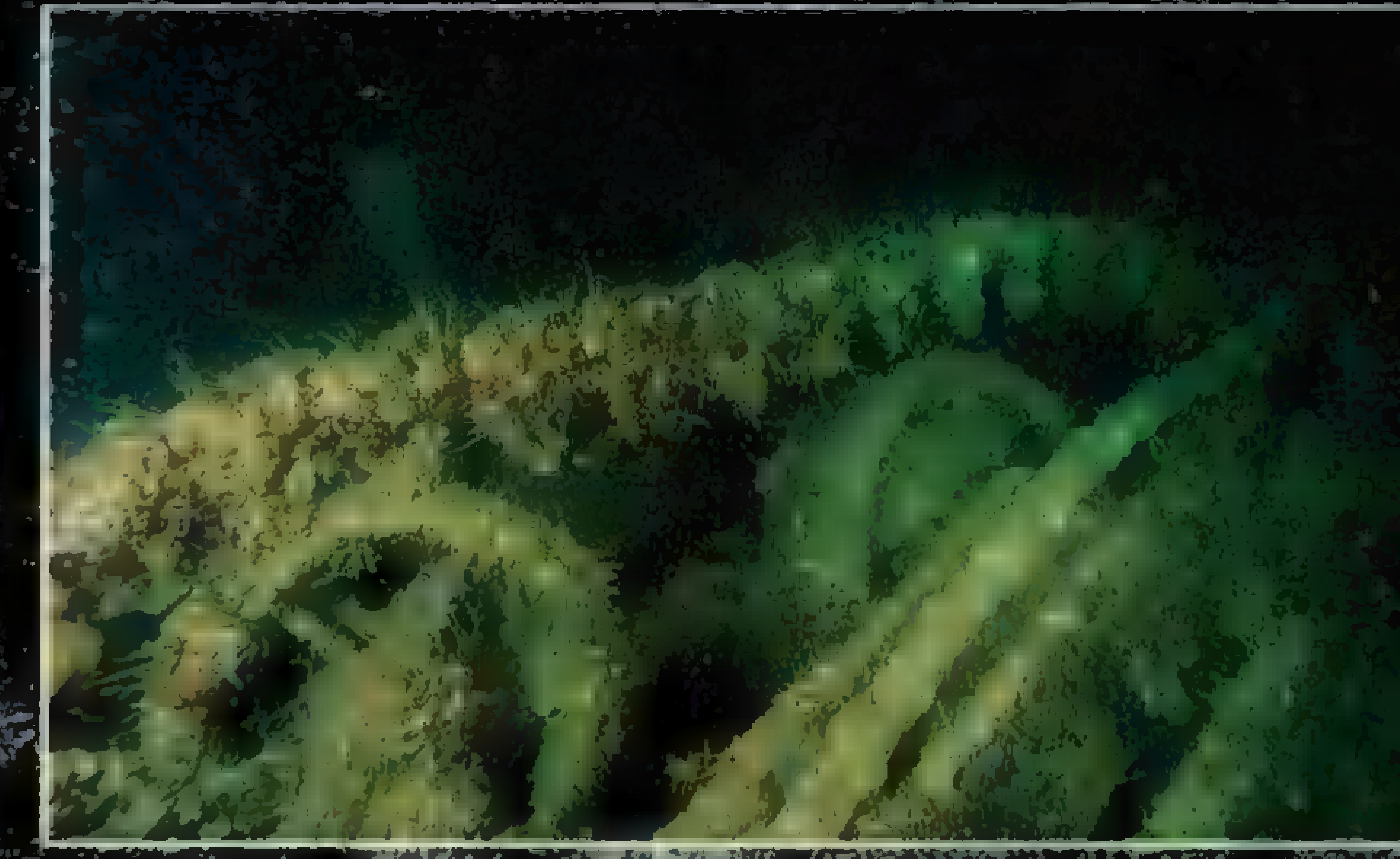
Into the Graveyard of the D-Day Armada

In the chill waters off Normandy lie rusting vessels and cargoes sunk on the way to battle. Time and strong currents have borne away the remains of D-Day's men, but metal hulks still loom beneath the surface.



An amphibious tank (inset, left), launched four miles offshore, was swamped in choppy seas on its way to Utah Beach. Its crew may have survived: Navy ships reported rescuing some men after seeing tanks that "went down to the bottom like rocks." Two weeks after D-Day, off Omaha Beach, a German mine sank a landing ship that carried 20 Sherman tanks. One still lies upside down (right, top) within the ship's hold. Inside the wreck of a wooden-hulled minesweeper a diver found a U.S. Navy flashlight (right, bottom). Immune to magnetic mines, the vessel was sunk by an acoustic mine on July 30.

Technology enables the hunt for wrecks



Sonar beams paint a ghostly image of the S.S. *Norfolk* (below), a 410-foot-long cargo ship that hit a mine on July 20. A National Geographic team, aided by French undersea explorer Bertrand Sciboz, used sonar and cameras to find and record remnants of the invasion fleet. Sciboz, working for French government agencies, helps clear wrecks and unexploded ordnance. As recently as May 2001, a trawler sank with [illegible] aboard—a tragedy blamed on a wartime wreck.

Underwater archaeologists of the U.S. Naval Historical Center have begun a survey of D-Day wrecks off Omaha and Utah Beaches.

[illegible] FOR NATIONAL GEOGRAPHIC (SONAR IMAGE); BRIAN J. SKERRY

enemy hands, the invasion would have failed or been scuttled—a distinct possibility in the anxious days after Exercise Tiger.

BIGOT was a code word within a code word, a security classification beyond Top Secret. When planners adopted Neptune as the code word for the naval and amphibious aspects of the invasion, they realized that greater protection had to be given to any document or map that even hinted at the time and place of D-Day. They chose the odd code word BIGOT by reversing the letters of two words—To Gib—that had been stamped on the papers of officers going to Gibraltar for the invasion of North Africa in November 1942.

Those who were to get date-and-place information were given special security background checks. If they qualified, they were described as "Bigoted." So when Eisenhower learned about the catastrophe off Slapton Sands, he wanted to know whether any of the dead or missing had been Bigoted. About ten men had. Those bodies were found and their documents collected. But had the Germans found any secrets on other bodies? Allied code breakers, who eavesdropped on German communications, listened for days to determine whether the Germans had gained any new intelligence about D-Day. They had not. D-Day's secrets were still safe.

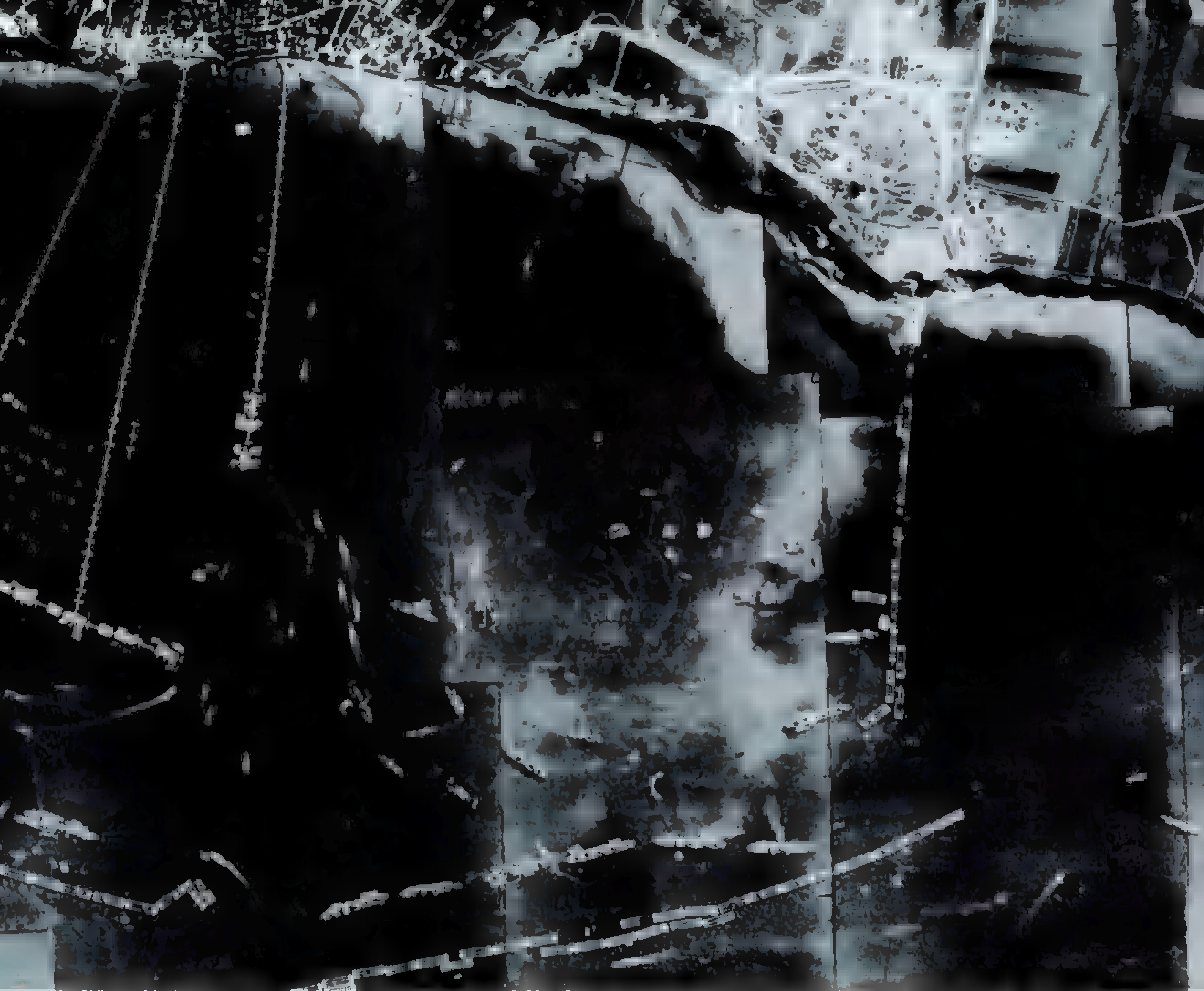
The BIGOT maps and documents were created in isolated cocoons of secrecy. One was hidden in Selfridges department store in London. BIGOT workers entered and left Selfridges by a back door, many of them knowing only that they were delivering scraps of information that somehow contributed to the war effort. Others with BIGOT clearances worked on Allied staffs scattered around London and southern England. So restricted was the BIGOT project that when King George visited a command ship and asked what was beyond a curtained compartment, he was politely turned away because, as a sentinel officer later said, "Nobody told me he was a Bigot."

The system occasionally broke down. In March 1944 a U.S. Army sergeant accidentally sent a package of BIGOT papers, some containing the target date and place

Thrusting through time, a sea-camouflaged gun summons a diver to the troopship U.S.S. *Susan B. Anthony*, sunk by a mine the day after D-Day. Aboard were more than [illegible] soldiers heading for the invasion beaches. U.S. and British ships rescued every man. Transferred to landing craft, they all got ashore—and went to war.

An aerial montage shows Allied ingenuity after D-Day. Old ships and concrete caissons were deliberately sunk to form a mile-long artificial harbor off Gold Beach, landing site for British troops. Supply ships could dock at the mid-harbor pier, linked to shore by pontoon roadways. Battered caissons (below) are all that remain of the port, which delivered 300,000 tons of supplies before the July capture of Cherbourg gave Allies a real harbor.

IMPERIAL WAR MUSEUM, LONDON (ABOVE), ALEXANDRA BOULAT



of the invasion, to his sister. The family was of German descent, and the sister lived in a German section of Chicago. By chance the package broke open in a Chicago post office. Postal authorities saw BIGOT and Top Secret stamped on documents and called the FBI. Investigators cleared the soldier of espionage, though he was confined to his quarters until after D-Day. The FBI put everyone who had seen the papers under surveillance. Another serious breach came in May when a U.S. major general told guests at a London dinner party that D-Day would come before June 15. He was demoted and packed off to the United States, as was a Navy captain who had blabbed too much at another party.

The strangest breach of security came from the London *Daily Telegraph*, whose crossword puzzles alarmed BIGOT security officers. One puzzle, on May 2, included "Utah" in its answers. Two weeks later, "Omaha" appeared as an answer. The puzzle's author, a schoolmaster, was placed under surveillance. Next came "Mulberry," code name for artificial harbors that were secretly being built in England for use off invasion beaches. Then came the most alarming answer of all: "Neptune."

This time the schoolmaster was arrested. Confounded investigators finally decided that the words had been the product of an incredible series of coincidences. Not until 1984 was the mystery solved: One of the schoolmaster's pupils revealed that he had picked up the words while hanging around nearby camps and eavesdropping on soldiers' conversations. He then passed the odd words on to his unwitting schoolmaster when he asked his pupils to provide ingredients for his crosswords.

But nothing was more secret—or more vital to Operation Neptune—than the mosaic of Allied intelligence reports that cartographers and artists transformed into the multihued and multilayered BIGOT maps. On them were portrayed details of Hitler's vaunted Atlantic Wall, a network of coastal defenses designed to repel invaders.

Shooting Without Guns

and other pilots skimmed the shore, dropping as low as 30 feet. Men scurried (right) as the P-38 zoomed over, photographing obstacle patterns. One plane nicked a church steeple; another returned to England trimmed with tree branches. The pilots' courage produced photos of beach barriers that D-Day mapmakers added to their maps.

Army Air Forces photo pilots usually flew at 10,000 feet and above. But in May 1944 [illegible] got orders to fly low and photograph the Normandy coast from unarmed P-38s. One of the pilots was Allen Keith (above, at left, with his ground crew in 1944, and today, right, with a P-38). Keith

COLLECTION OF ALLEN KEITH (TOP), GEORGE STEINMETZ

To discover what the Allied invaders faced, American, British, and French operatives risked their lives—and sometimes gave their lives—in the process of filling in the BIGOT maps. Revelations about Normandy's undulating seafloor came from frogmen who also got sand samples on beaches patrolled by German sentries. Such BIGOT map notations as "antitank ditch around strongpoint" or "hedgehogs 30 to 35 feet apart" were often the gifts of French patriots. French laborers conscripted by the Nazis paced distances between obstacles or kept track of German troop movements. A housepainter, hired to redecorate German headquarters in Caen, stole a blueprint of Atlantic Wall fortifications.

French Resistance networks passed on precious bits of information, particularly the condition of bridges and canal locks. Wireless telegraph operators transmitted in bursts to evade German radio-detection teams. Other messages got to England in capsules, borne by homing pigeons that the Royal Air Force had delivered to French Resistance agents in cages parachuted into German-occupied Normandy. Germans, aware of the winged spies, used marksmen and falcons to bring them down. But thousands of messages got through.

BIGOT MAPS BEGAN with information gleaned from old scenic postcards of the Normandy coast and charts from the Napoleonic era. Next came the special deliveries from the French Resistance. Then in mid-May 1944, BIGOT mapmakers asked for low-level aerial photos of the coast. Pilots, trained to fly at 10,000 feet, called this wave-top flying "dicing" because they felt that in their unarmed and unarmored aircraft they were rolling the dice with death.

On May 6, Lt. Albert Lanker of the 31st Photographic Reconnaissance Squadron

UPI/CORBIS-BETTMANN

made the first dicing flight. Flying 30 feet above the Channel to slip under German radar, he turned sharply over a large dune on the Normandy coast and, at 360 mph, buzzed German soldiers working on defenses. Photo interpreters examined his photos and discovered that the dune was a gun emplacement, which was added to the maps.

Lt. Allen Keith, while zooming along at about 360 mph, hit a gull. The bird smashed through the windscreen but was stopped by newly installed bulletproof glass on brackets in front of the pilot. Spattered by blood and feathers, Keith could not see for a few seconds but wiped off his goggles and never lost control. Photos from another of the dicing missions, this one flown by Lt. Garland A. York, revealed log posts jammed in the sand, angled seaward and topped by mines. Other photos showed that the tidal flats of the beaches were studded with "hedgehogs"—steel rails welded together and resembling giant versions of children's jacks. The obstacles were designed to impale or rip open the hulls of landing craft approaching the beach at high tide.

Some air reconnaissance photographs were processed so fast that fingerprints still appear on the negatives, showing that they were snatched from the developer for circulation. "Recent wave-top aerial photo reconnaissance," says a May 29 intelligence bulletin, "reveals that practically all types of underwater obstacles may be armed with . . . mines." The dicing photos convinced planners that landing craft had to come in at low tide and discharge troops before hitting the obstacles. So mapmakers had to figure ways to display tides and beach slopes.

Head-on aerial photos of the Normandy shoreline made by the dicing flights produced eye-level views for Allied coxswains to use as they aimed their *(Continued on page 28)*

COLLEVILLE-SUR-MER
Cabourg
EXIT-E3
BAIE DE
FOX RED
FOX GREEN
FLOOD CURRENT
LEGEND
NOTE to COXSW

St. Laurent-sur-Mer

EASY RED

EASY GREEN

DOG RED

LA SEINE

OMAHA BEACH-EAST (Colleville-sur-Mer)

TOP SECRET - BIGOT

UNTIL DEPARTURE FOR COMBAT OPERATIONS THEN THIS SHEET BECOMES RESTRICTED

D-Day USED THIS CHART DURING STAY ON THE BEACH

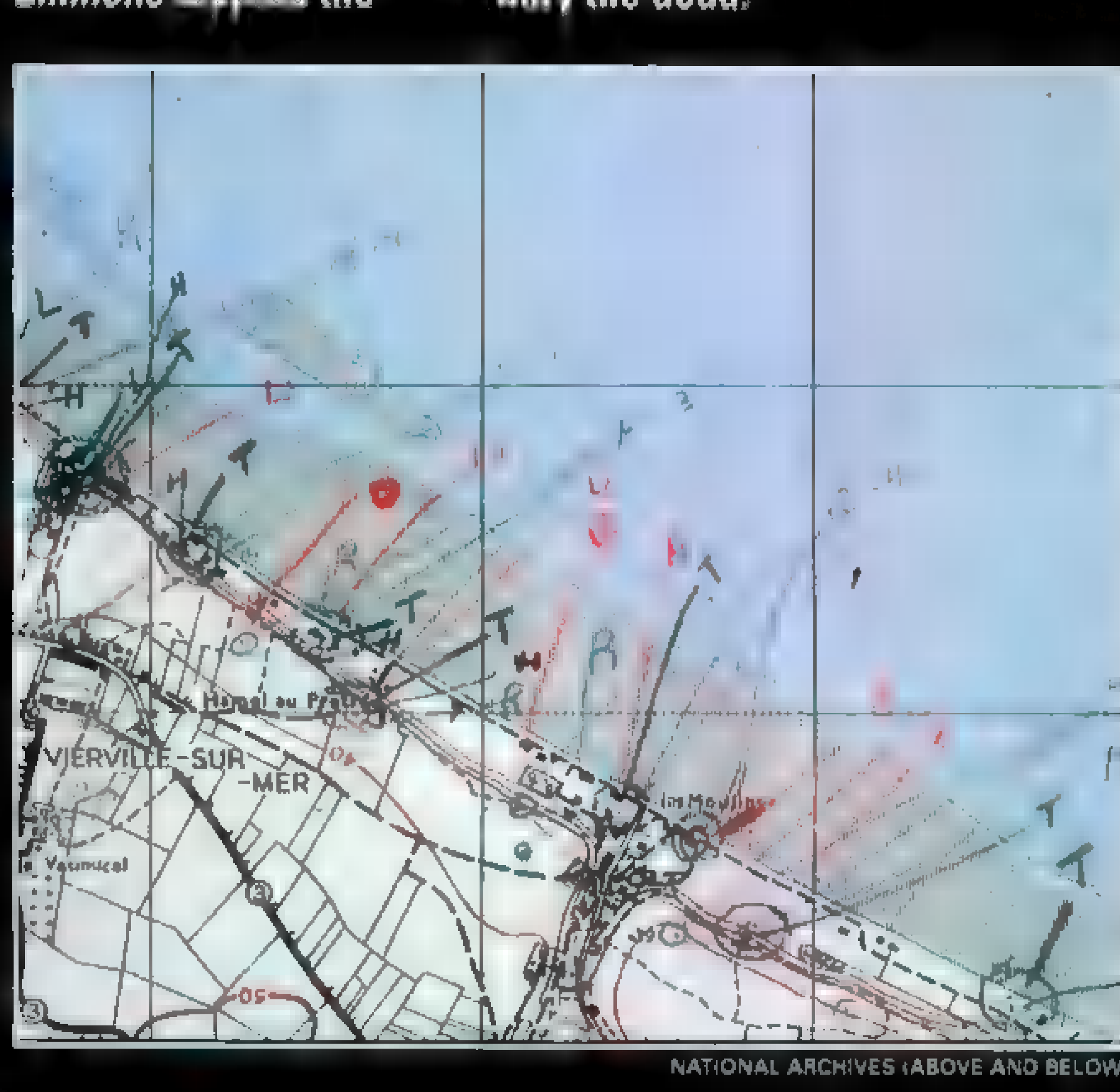
Landed 0730 June 6 1944

Stamped BIGOT—code name for a security level beyond Top Secret—this map got U.S. troops to the eastern sectors of Omaha Beach. A topographic watercolor below the map gave an eye-level view of shore. Only the highest ranking officers and a few specialists held BIGOT clearance.

BIGOT: A Map to Die For

COLLECTION OF JOE VAGHI (LEFT); MARK THIESSEN

Joe Vaghi (above) still cherishes the BIGOT map that got him to Omaha Beach. He was a beachmaster—a D-Day "traffic cop"—along Easy Red sector. When he reached shore, he saw a house he had noted on the map. "I knew I was in the right place," he says. Many map details came from Allied spies who risked their lives in German-occupied France. Maps such as Vaghi's, which shows Omaha Beach East (left), detailed underwater obstacles, trenches, minefields, and German defenses—from bunkers to individual mortars. A watercolor strip from another BIGOT map (bottom of pages) shows the Colleville-sur-Mer spire—an observation post for German gunners. When pinned-down men radioed for help, the sharpshooting U.S.S. *Emmons* toppled the spire. Navy gunners, aided by BIGOT maps, knocked out eight German gun emplacements covering Omaha Beach landing sites. A naval map (below) gave invasion ships specific German targets. Firing over the heads of her own countrymen, one U.S. destroyer silenced an 88-mm German gun by putting two rounds through the gun shield. Beyond targets, BIGOT maps could show where to bivouac, where to set up supply dumps—even where to bury the dead.



NATIONAL ARCHIVES (ABOVE AND BELOW)

COLLEVILLE

EXIT E3

The Lost Fleet of Operation Neptune

Destined for the attack on Normandy but claimed by [illegible] sea, at least 200 ships and landing craft sank off the invasion beaches. Some, such [illegible] the *Corry,* went down on D-Day. But from June 7 to July 4—when the millionth man [illegible] landed—German mines and torpedoes continued to sink ships off the coast.

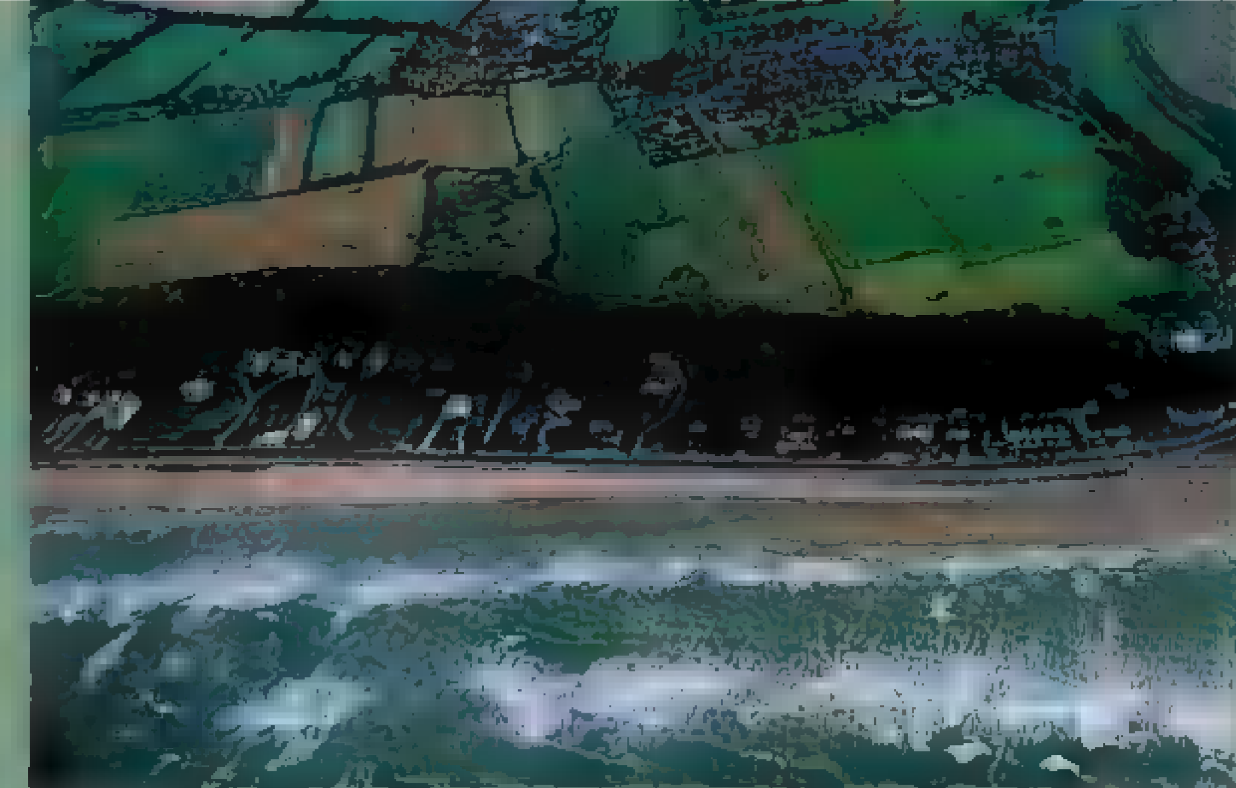
Operation Neptune, code name for the naval portion of the invasion, [illegible] 5,300 ships, boats, and amphibious craft [illegible] the English Channel before dawn on June 6, 1944. Nearly 300 minesweepers led the way, clearing broad paths for the ships and smaller landing craft that carried nearly 200,000 men to the five beaches: Sword [illegible] Gold for British forces, Juno for Canadians, Omaha and Utah for Americans.

Landing craft were to assemble in neat rows at precise points in the cleared pathways. But choppy [illegible] and confusion produced what one naval officer called [illegible] "disoriented and disorganized hodgepodge." With bullhorns and luck, Neptune wranglers rounded up strays, and by dawn the first [illegible] headed for the beaches.

Many of the [illegible] believed that German defenses [illegible] being pulverized by Allied bombers and warships. One briefing officer in England had promised that "every grain of sand will be turned [illegible] twice before the first wave hits [illegible] beach." Because of cloud cover, errors, and fear of hitting Allied troops, the bombs dropped far from their intended targets—and the Germans were there, waiting.

Village of Arromanches-les-Bains, near the Gold Beach landing site

ALEXANDRA BOULAT (ALL)



Omaha Beach with the village of Colleville-sur-Mer beyond

[illegible] June 8

The *Lawford* was a U.S.-built destroyer escort given to the British. She was bombed by German aircraft and sank.

[illegible] August 19

A mine split the *Harpagus* in two. Crewmen later salvaged the stern of this British freighter, added a new forward section, and rechristened her the *Halfpagus.*

S.S. Empire Rosebery August 24

A German mine tore through the British tanker *Empire Rosebery* and touched off gasoline fumes. The blast hurled the lifeboats into the sea. The ship, ripped in half, went down with 13 men.

H.M.S. Swift June 24

H.M.S. Magic [illegible]

Human torpedoes sank the *Magic* and the *Cato,* both British minesweepers. Of 26 human torpedoes in the attack, nine were destroyed.

[illegible]

German "human torpedoes" sank the British minesweeper *Pylades* and damaged the Free Polish cruiser *Dragon,* manned by Polish patriots. The *Dragon* was later scuttled for a breakwater off Gold Beach.

H.M.S. Svenner June 6

Three fast German *Schnellboote*—called E-boats by the Allies—sank a Norwegian destroyer, the *Svenner.* The British destroyer *Swift* picked up nearly 100 survivors, but 34 men were lost. A mine then sank the *Swift* on June 24.

Lisieux

Caen

Orne

Ouistreham

Varaville

Dives-sur-Mer

Cabourg

Riva-Bella

Lion-sur-Mer

Luc-sur-Mer

Saint-Aubin-sur-Mer

Bernières-sur-Mer

Courseulles-sur-Mer

Arromanches-les-Bains

Seulles

Villers-sur-Mer

Deauville-les-Bains

Honfleur

Seine

HIGH TIDE MARK

Cap de la Hève

Le Havre

Montivilliers

Épouville

SWORD

JUNO

GOLD

Bay of

GERMAN HUMAN TORPEDOES

These were one-man torpedoes, midget [illegible] partly above the surface. Operators were not on a suicide mission, as the Allies suspected. The pilot would [illegible] torpedo—then hope for pickup by an accompanying ship.

British Third Infantry Division

Canadian Third Infantry Division

British 50th Infantry Division

Scale for landing craft silhouettes

0 ft 100

0 m 50

LST Landing Ship, Tank. These were 328 feet long and capable of landing with 500 tons. After unloading their cargo, versa-[illegible] LSTs became hospital ships, bringing 41,035 wounded [illegible] to England.

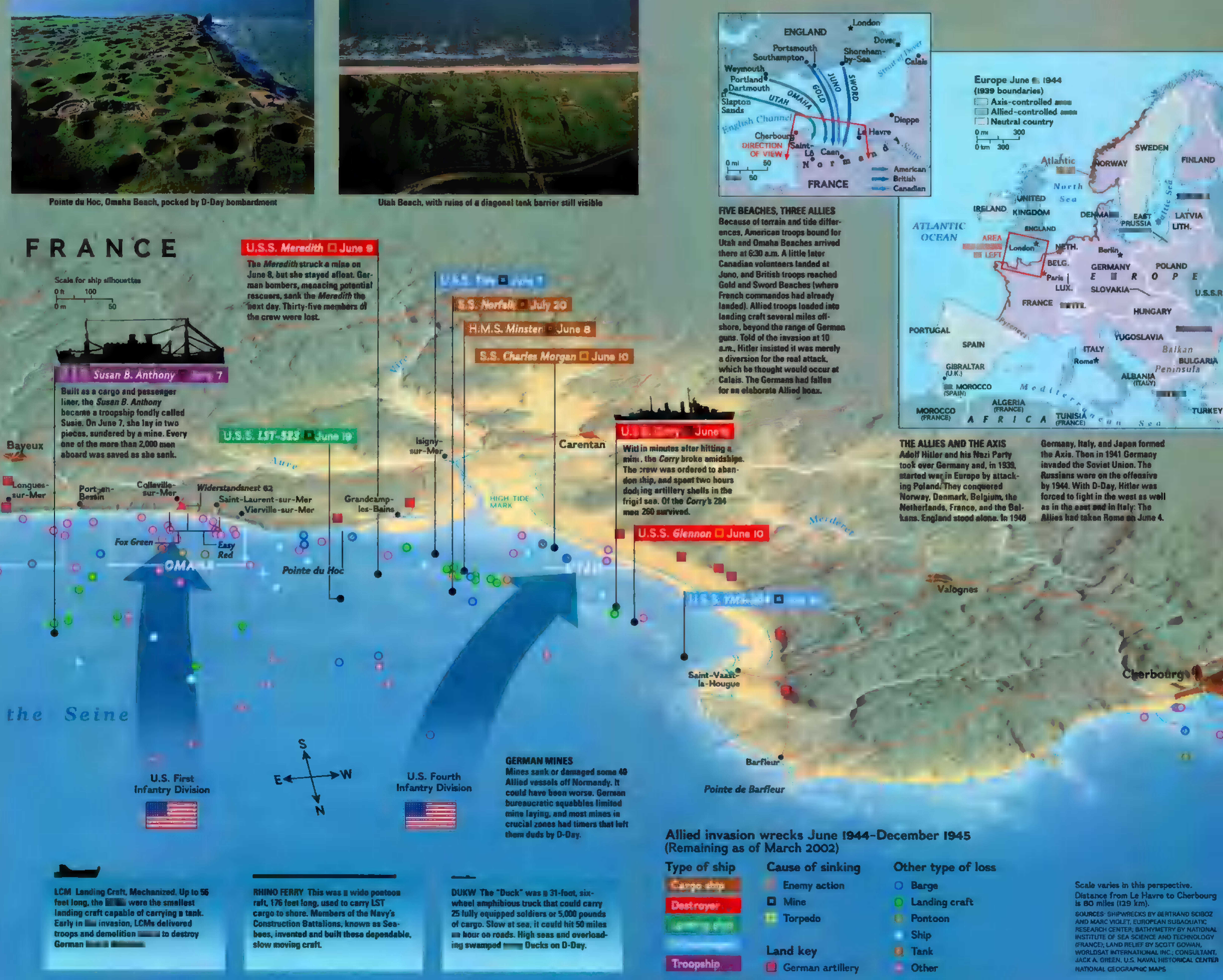
LCVP Landing Craft, Vehicle, Personnel. These were about 36 feet long. They were called Higgins Boats after inventor Andrew Higgins, who, said General Eisenhower, "won [illegible] for us."

LCP(L) Landing Craft, Personnel (Large). These were also 36 feet long and were capable of carrying 36 men or some 8,000 pounds of cargo. Several [illegible] these were "smokers," [illegible] produce [illegible] during the invasion.

LCT Landing Craft, Tank. The largest version used on D-Day ran 119 feet long. These could each carry three 50-ton tanks or 150 tons of cargo. Some LCTs carried two tanks side by side, set to fire over the bow [illegible]

LCI(L) Landing Craft, Infantry (Large). These were 160 feet long. They could land 188 men on lowered bow ramps or carry 75 tons of cargo. U.S. Coast Guard coxswains manned [illegible] LCIs, including [illegible] British [illegible] Canadian beaches.

LCF Landing Craft, Flak. These ran up to 196 feet long. A converted LCT, the LCF was armed with anti-aircraft guns to shield troops from close-range air attacks. At Utah [illegible] LCF [illegible] brought [illegible] a German aircraft.



Pointe du Hoc, Omaha Beach, pocked by D-Day bombardment
Utah Beach, with ruins of a diagonal tank barrier still visible
FRANCE
Scale for ship silhouettes
0 ft 100
0 m 50
Susan B. Anthony
Built as a cargo and passenger liner, the Susan B. Anthony became a troopship fondly called Susie. On June 7, she lay in two pieces, sundered by a mine. Every one of the more than 2,000 men aboard was saved as she sank.
U.S.S. Meredith June 9
The Meredith struck a mine on June 8, but she stayed afloat. German bombers, menacing potential rescuers, sank the Meredith the next day. Thirty-five members of the crew were lost.
S.S. Norfolk July 20
H.M.S. Minster June 8
S.S. Charles Morgan June 10
U.S.S. LST-523 June 19
June 6
the Corry broke amidships. The crew was ordered to abandon ship, and spent two hours dodging artillery shells in the frigid sea. Of the Corry's 284 men 260 survived.
U.S.S. Glennon June 10
Bayeux
Longues-sur-Mer
Port-en-Bessin
Colleville-sur-Mer
Widerstandsnest 62
Saint-Laurent-sur-Mer
Vierville-sur-Mer
Grandcamp-les-Bains
Isigny-sur-Mer
Carentan
Aure
Vire
Merderet
HIGH TIDE MARK
Fox Green
Easy Red
Pointe du Hoc
Valognes
Saint-Vaast-la-Hougue
Cherbourg
Barfleur
Pointe de Barfleur
the Seine
S
E
W
N
U.S. First Infantry Division
U.S. Fourth Infantry Division
GERMAN MINES
Mines sank or damaged some 40 Allied vessels off Normandy. It could have been worse. German bureaucratic squabbles limited mine laying, and most mines in crucial zones had timers that left them duds by D-Day.
ENGLAND
London
Dover
Portsmouth
Southampton
Shoreham-by-Sea
Calais
Weymouth
Portland
Dartmouth
Slapton Sands
English Channel
UTAH
OMAHA
GOLD
JUNO
SWORD
Dieppe
Cherbourg
Le Havre
DIRECTION OF VIEW
Saint-Lô
Caen
Normandy
Seine
0 mi 50
0 km 50
FRANCE
American
British
Canadian
FIVE BEACHES, THREE ALLIES
Because of terrain and tide differences, American troops bound for Utah and Omaha Beaches arrived there at 6:30 a.m. A little later Canadian volunteers landed at Juno, and British troops reached Gold and Sword Beaches (where French commandos had already landed). Allied troops loaded into landing craft several miles offshore, beyond the range of German guns. Told of the invasion at 10 a.m., Hitler insisted it was merely a diversion for the real attack, which he thought would occur at Calais. The Germans had fallen for an elaborate Allied hoax.
Europe June 1944
(1939 boundaries)
Axis-controlled
Allied-controlled
Neutral country
0 mi 300
0 km 300
Atlantic
North Sea
SWEDEN
FINLAND
NORWAY
IRELAND
UNITED KINGDOM
ENGLAND
ATLANTIC OCEAN
AREA
LEFT
London
DENMARK
EAST PRUSSIA
LATVIA
LITH.
NETH.
Berlin
BELG.
GERMANY
POLAND
Paris
LUX.
E U R O P E
U.S.S.R.
SLOVAKIA
FRANCE
HUNGARY
PORTUGAL
Pyrenees
SPAIN
YUGOSLAVIA
Balkan Peninsula
ITALY
BULGARIA
Rome
GIBRALTAR (U.K.)
ALBANIA (ITALY)
MOROCCO (SPAIN)
MOROCCO (FRANCE)
ALGERIA (FRANCE)
TUNISIA (FRANCE)
TURKEY
AFRICA
Mediterranean Sea
THE ALLIES AND THE AXIS
Adolf Hitler and his Nazi Party took over Germany and, in 1939, started war in Europe by attacking Poland. They conquered Norway, Denmark, Belgium, the Netherlands, France, and the Balkans. England stood alone. In 1940 Germany, Italy, and Japan formed the Axis. Then in 1941 Germany invaded the Soviet Union. The Russians were on the offensive by 1944. With D-Day, Hitler was forced to fight in the west as well as in the east and in Italy. The Allies had taken Rome on June 4.
Allied invasion wrecks June 1944-December 1945
(Remaining as of March 2002)
Type of ship
Cargo ship
Destroyer
Troopship
Cause of sinking
Enemy action
Mine
Torpedo
Land key
German artillery
Other type of loss
Barge
Landing craft
Pontoon
Ship
Tank
Other
LCM Landing Craft, Mechanized. Up to 56 feet long, the were the smallest landing craft capable of carrying a tank. Early in invasion, LCMs delivered troops and demolition to destroy German
RHINO FERRY This was a wide pontoon raft, 176 feet long, used to carry LST cargo to shore. Members of the Navy's Construction Battalions, known as Seabees, invented and built these dependable, slow moving craft.
DUKW The "Duck" was a 31-foot, six-wheel amphibious truck that could carry 25 fully equipped soldiers or 5,000 pounds of cargo. Slow at sea, it could hit 50 miles an hour on roads. High seas and overloading swamped Ducks on D-Day.
Scale varies in this perspective.
Distance from Le Havre to Cherbourg is 80 miles (129 km).
SOURCES: SHIPWRECKS BY BERTRAND SCIBOZ AND MARC VIOLET, EUROPEAN SUBAQUATIC RESEARCH CENTER; BATHYMETRY BY NATIONAL INSTITUTE OF SEA SCIENCE AND TECHNOLOGY (FRANCE); LAND RELIEF BY SCOTT GOWAN, WORLDSAT INTERNATIONAL INC.; CONSULTANT, JACK A. GREEN, U.S. NAVAL HISTORICAL CENTER
NATIONAL GEOGRAPHIC MAPS

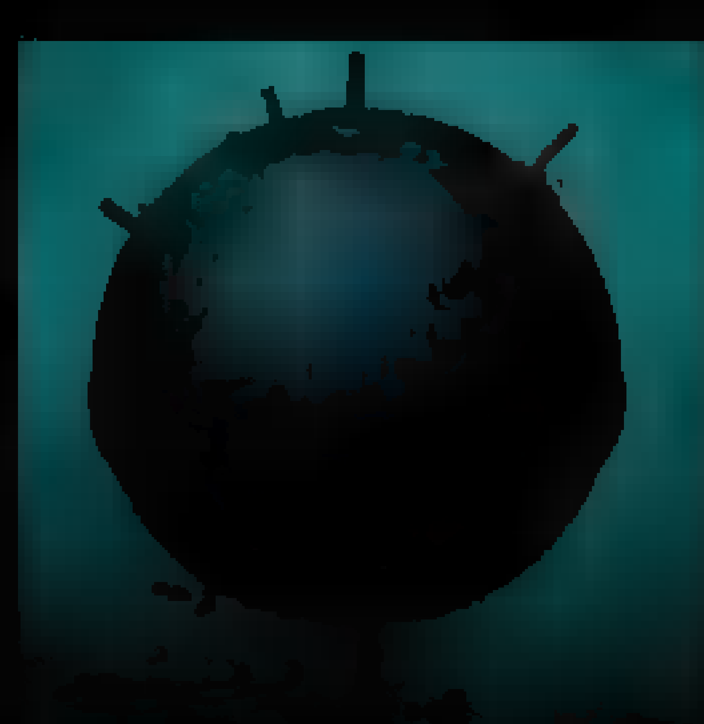
Cracking the Atlantic Wall

Carried in from an offshore transport, GIs wade ashore at Omaha Beach (above). At Utah Beach (left) troops, tanks, and trucks reach the shore. British men on Sword Beach (below) advance while dragging wounded soldiers from the sea. All are penetrating what Hitler imagined as his Atlantic Wall, a series of coastal defenses—from concrete gun emplacements to ditches—said to stretch from Norway to the Pyrenees.

Normandy's defender, German Field Marshal Rommel, dismissed the wall as Hitler's "cloud-cuckoo-land" and focused on fortifying the shore, saying, "Our only possible chance will be at the beaches." Mines and other obstacles were placed to disable landing craft. Men who made it to shore had to cross several hundred yards of open beach, cut through barbed wire, dodge hidden mines—162,000 had been laid only months before—and advance toward German bunkers, whose machine guns were sited to rake the beach. Most of the invading forces managed to survive the beach and take higher ground. By the end of the day the invaders held some 45 miles of Normandy shore. The Atlantic Wall had been resoundingly breached.

NATIONAL ARCHIVES (TOP AND … IMPERIAL …

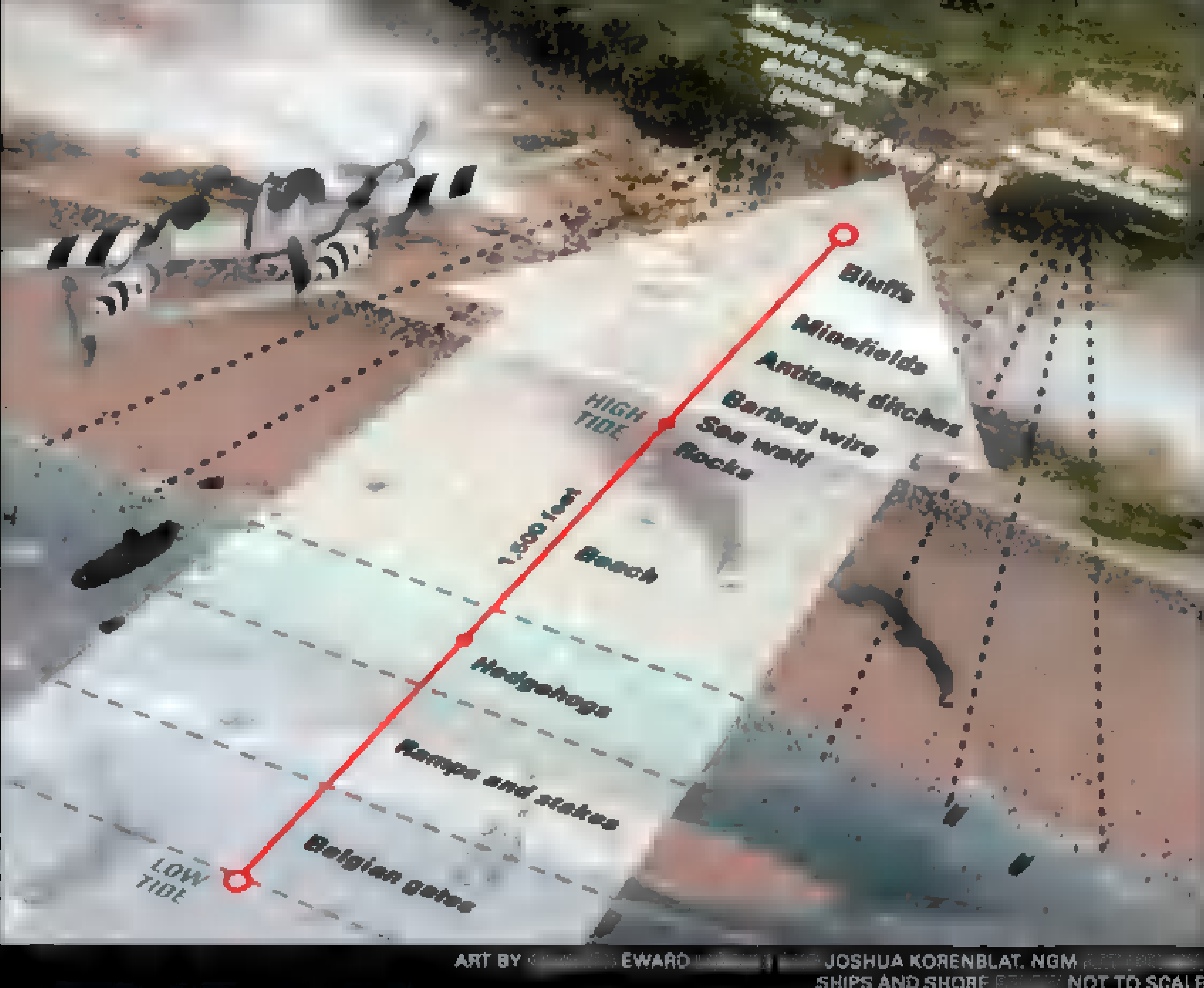
A P-38 giving air cover (below) sports the stripes that all Allied aircraft wore on D-Day to identify friend from foe. Allies held the air but Germans fiercely defended the ground. In bullet-sprayed surf, Allied troops and ships ran a long obstacle course that included sea mines, massive barriers called Belgian gates, and welded rails called hedgehogs, defenses appropriated by Germans from conquered nations and largely visible when the invasion began at low tide. Land mines on stakes also sank many craft, but designed for dry ground, they sometimes failed in the sea.



Anchored naval mine

Hedgehog

Belgian gate



ART BY EWARD AND JOSHUA KORENBLAT, NGM
SHIPS AND SHORE NOT TO SCALE

German defenses unleashed an arsenal against Allied troops approaching shore.

SHORE — 1 mile — 2 — 3 — 4 — 5 — 6 — 7 — 8 — 9 — 10 — 11

Destroyers came within a half mile of shore throughout the day, covering landing troops.

Swimming tanks were sometimes launched 3 miles offshore; some of these tanks sank immediately.

Destroyers initially were positioned 3.5 to 4 miles offshore. They had 5-inch guns with a maximum range of 10.3 miles.

Battleships were positioned 3.5 to 7 miles offshore. Some had 14-inch guns with a 13-mile range.

Landing craft at Omaha Beach were launched beyond the range of German fire. They carried vehicles, personnel, and artillery.

Allied warships and German shore batteries dueled from D-Day's dawn to dusk—and into the days beyond. A 30-minute bombardment launched the invasion, as distant Allied ships fired over the heads of troops on their way to shore. German guns zeroed in on landing craft and beaches. Off Omaha, destroyers moved in as floating artillery. Responding to calls for fire support, they knocked out German guns, allowing troops to move to higher ground. One soldier radioed the message: "Thank God for the United States Navy."

(Continued from page 17) landing craft toward D-Day beaches. BIGOT artists turned the photos into paintings that showed landmarks, such as church steeples and seaside houses. One of these artists was Navy Lt. Frederick S. Wight, who later would be renowned in civilian life as a curator and historian of modern art in the U.S.

Another BIGOT artist was Navy Lt. William A. Bostick, who worked in a commandeered London apartment. He and other artists used the pilots' panoramic photos "to make watercolors of the beaches as landing craft skippers would see them as they approached." Bostick's watercolors, emphasizing terrain features and landmarks, formed a narrow band under the maps. On the back of the maps was an invasion almanac with information about sun, moon, tide, and currents from May 25 to June 21. (The precise date of the invasion was not set until after the maps were finished.)

Bostick was especially proud of an ingenious transparent overlay that showed profiles of large and small landing craft. By adjusting the sheet over a graph of the beach slope, navigators could see where their craft would run aground and what the water depth would be. "The Army called them maps and the Navy called them charts," Bostick said. "So we called them chart/maps—pieces of paper that showed the Navy where to land the Army."

While the maps were evolving, a group of intelligence officers was busy crafting the greatest hoax of the war—a spy-running

operation that was not fully revealed until the 1980s. Earlier in the war, British counterintelligence officers gave captured German spies a simple choice: Be hanged or work for us. Most chose to live. Directed by their handlers, the turncoats used seemingly clandestine radios to transmit to German spymasters a mix of real and counterfeit information. The operation, run by the wryly named XX (double cross) Committee, was meant to convince the German high command that the invasion would strike at either Nazi-held Norway or at Calais, across the English Channel from Dover.

Adding to the deception were two huge but imaginary military units. One, supposedly preparing to invade Norway, provided German radio interceptors with the busy radio traffic of a simulated 350,000-man army whose needs included "ski training" and "handbooks on engine functioning in low temperatures." A second phantom army appeared poised to strike at Calais under the command of Lt. Gen. George S. Patton. Spies tipped the Germans that Patton had arrived in England to lead the Calais invasion. Luftwaffe reconnaissance flights photographed the evidence of Patton's army: rows of tanks and barracks, fleets of landing craft in nearby ports, even an oil dock. All were illusions, made of wood, rubber, and papier-mâché by fakers who included movie stagehands.

United by memory, Louise Hamel and a group of veterans gather for a D-Day anniversary rite on a bluff above Omaha Beach. She remembers "every second" of the day that American troops freed her town, Colleville-sur-Mer. The men remember the dead of their Sixth Naval Beach Battalion. Forty percent of the battalion's 363 men were killed or wounded in the invasion. On D-Day, a battalion survivor wrote, the "rising tide was drowning dying men and washing bodies ashore." To honor those who fell, these veterans came back to Omaha Beach, stood at a memorial lined with names of the dead, and dedicated a plaque of remembrance.

AN XX COMMITTEE OPERATIVE added her contribution by reporting to the Germans that she was dating a staff officer of the nonexistent U.S. Fourteenth Army, which had moved its headquarters to the Dover area, opposite Calais, to prepare the invasion. (So complete was the deception that Fourteenth Army shoulder patches appeared alongside real ones in a 1944 NATIONAL GEOGRAPHIC booklet on U.S. armed forces insignia.)

But what about reports the Nazis were receiving of a Normandy invasion? That, said the Germans' most trusted spy (and XX's star performer) would only be a diversion. A message sent on June 9—and read by Hitler himself—warned that D-Day was a trap designed to draw off German reserves so that the Allies could launch a decisive attack, "probably . . . in the Pas de Calais area." The ruse would keep German forces in Calais for weeks after D-Day, awaiting the "real" invasion.

While the Germans built up their forces around Calais, Field Marshal Rommel placed the underwater obstacles at Normandy that the dicers had spotted. Rommel had asked in vain for more cement and mines for Normandy. Denied, he made do with obstacles of timber and steel. "Our only possible chance will be at the beaches," he said. If the invaders came to Normandy, he would stop them there. He expected them to come in on a high tide and impale their craft on his barriers.

By late May, Rommel's men were in their bunkers overlooking the Normandy beaches, wondering if the invaders would land there—or hundreds of miles away. At *Widerstandsnest* (strongpoint) 62, overlooking what would be

Living History

Haunted by silenced German guns, the Normandy coast lures survivors and pilgrims like these Belgian reenactors (left) who, costumed as GIs, try to fathom a past they [illegible] not live. Attached to the Internet Café is a museum that once was [illegible] communications bunker, first for Germans (who gave it a beach-cottage disguise), then for Americans, who seized it on D-Day. Former Navy radiomen Farrell Thompson (left, in green jacket) and Roger Chagnon, meeting for the first time since 1944, recall duty in the bunker: keeping in touch with ships supporting the invasion. The walls still bear scrawled names of 19 radiomen who served there.

[illegible] Longues-sur-Mer, D-Day began when three German 150-mm guns fired on the Allied fleet. The warships volleyed back and stilled two guns; later fire took out [illegible] third. Now restored, the battery (right) mutely recalls the firepower confronting the Allies. Up close at Omaha they faced German soldiers like Pfc. Hein Severloh (left), "shooting at anything that was moving." He holds a bullet given to him as a souvenir by a former GI; [illegible] was taken from Severloh's captured machine gun.

[illegible] BOULAT [illegible] AND CENTER) KARL JOHAENTGES

Omaha Beach, German troops were listening to popular music on a windup gramophone and reading letters by candlelight.

Sgt. Valentin Lehrmann learned that he had just become a father for the third time. The baby, Elfriede, was born May 26. Nearby, Pfc. Hein Severloh, the son of a farmer and at 21 a veteran of the Russian Front, brooded about his fate: "I knew if I did not kill them, they would kill me. All I wanted was to get out of this hell. All I wanted was to survive."

COLLECTION OF

Around the same time, invasion troops were pouring into sealed-off camouflaged camps on the English coast. At a camp in Weymouth the King and Queen of England paid a surprise visit that took them among men of the Sixth Naval Beach Battalion, Joe Vaghi's outfit. Someone in the queen's party handed 17-year-old sailor Clyde Whirty an American flag, which he attached to the bulldozer he was to use to clear paths on the Easy Red beachhead. When a buddy warned that the flag would draw German fire, Whirty, a thin, quiet-spoken man, shrugged and said, "If they kill me, they won't kill someone else."

On June 1 armed officer-messengers boarded the Allied vessels at the departure ports. Each commanding officer was handed a sealed envelope marked Top Secret. Inside was another sealed envelope. The Operation Neptune message inside revealed the date of D-Day: June 5, with a possible change to June 6 or 7. The message ended: "Destroy this by burning when you have read and understood."

The weather was stormy on June 5. The next day the sea was choppy but the storm had passed.

Soon after dawn on June 6, a fleet of Allied warships appeared in the steel gray fog off Normandy Beach and prepared to bombard the German fortifications detailed in the BIGOT map. Behind Utah Beach, German shore batteries fired first, some guns zeroing in on the U.S. destroyers *Fitch* and *Corry*. The ships were turning to starboard to line up parallel to the beach. They would then anchor to become steady gun platforms for the shore bombardment. At 6:10 a.m., exactly on schedule, Allied planes began laying smoke screens to hide the destroyers. But one of the planes was shot down before it could hide the *Corry*.

German guns immediately targeted the ship, which, while still firing, began twisting past plumes of near misses. Then, a little after 6:30, she struck a mine. Eight minutes later,

with the main deck underwater and the *Corry* breaking in half, the captain, Lt. Comdr. George Dewey Hoffman, ordered his 18 officers and 265 men to abandon ship. When all the living were in the 54-degree water, Hoffman joined them. The shelling continued, and more men died while struggling in the cold sea. By the time rescuing destroyers appeared two hours later, firing at Germans from one side of the ship while saving men on the other,

The shelling continued, and more men died struggling in the cold sea.

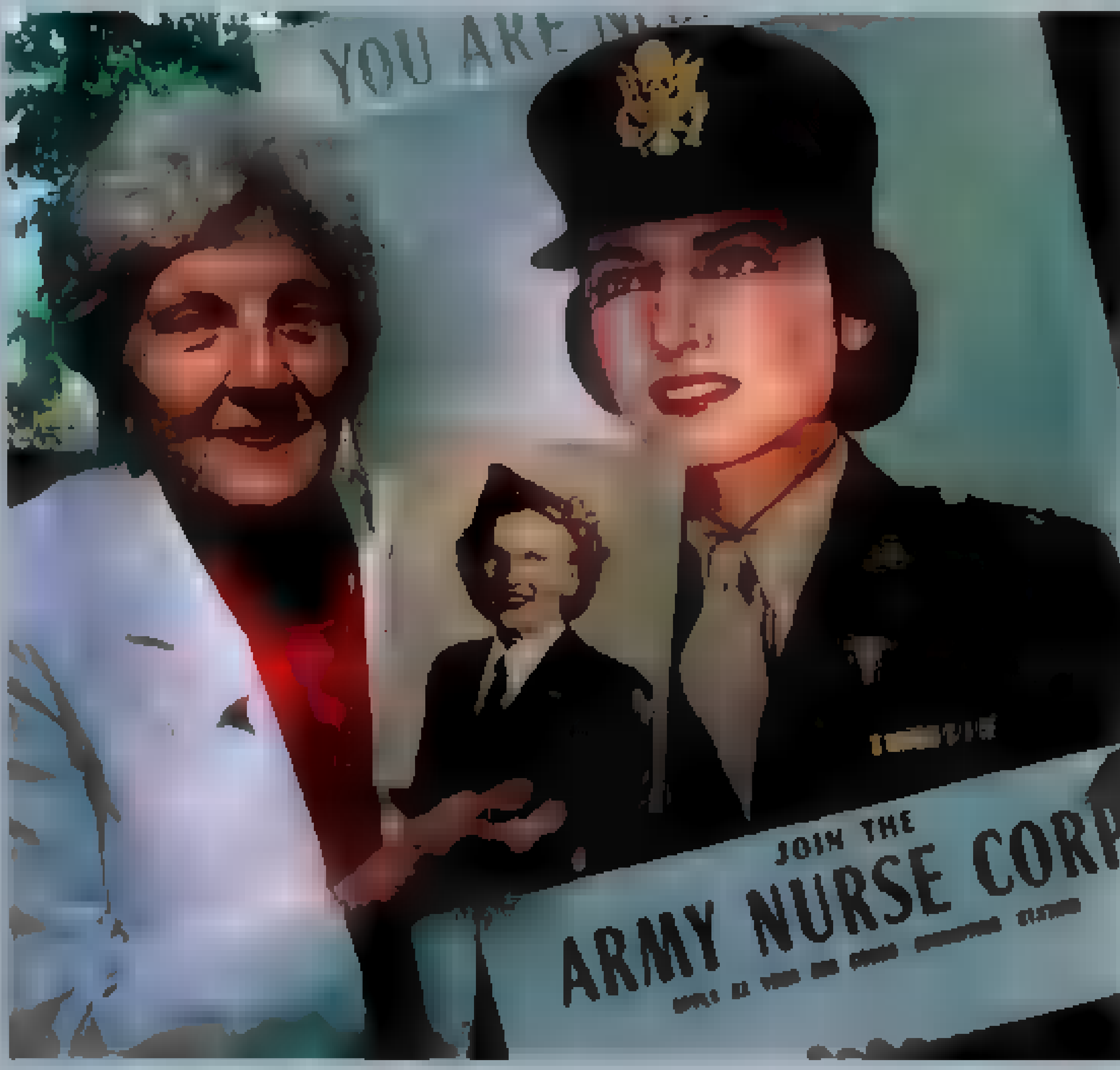
the *Corry*'s 260 survivors were near death. All told, the *Corry*, which had fired off 400 rounds during her few minutes of D-Day, lost 24 men. Her flag, snatched from the sinking ship by Lt. Paul Garray, still survives (pages 6-7).

At about 7:30, the Sixth Naval Beach Battalion began to land on Omaha Beach, at a site their BIGOT maps designated as Easy Red sector. Clyde Whirty's bulldozer, the American flag flying, rolled off a landing craft and hit a

COLLECTION OF GEORGE K. S. HARDY (ABOVE AND BACKGROUND)

Survivors of the U.S.S. *Corry*, who spent two hours in 54-degree water, clamber aboard the U.S.S. *Fitch* off Utah Beach. *Corry*'s captain, Lt. Comdr. George Dewey Hoffman (facing page), was last to leave the ship, which sank (below) after a mine broke her keel. German gunfire from shore killed ten men in the water. Of the 284 men aboard, 260 survived. Each year a dwindling band of survivors gathers to remember the day.

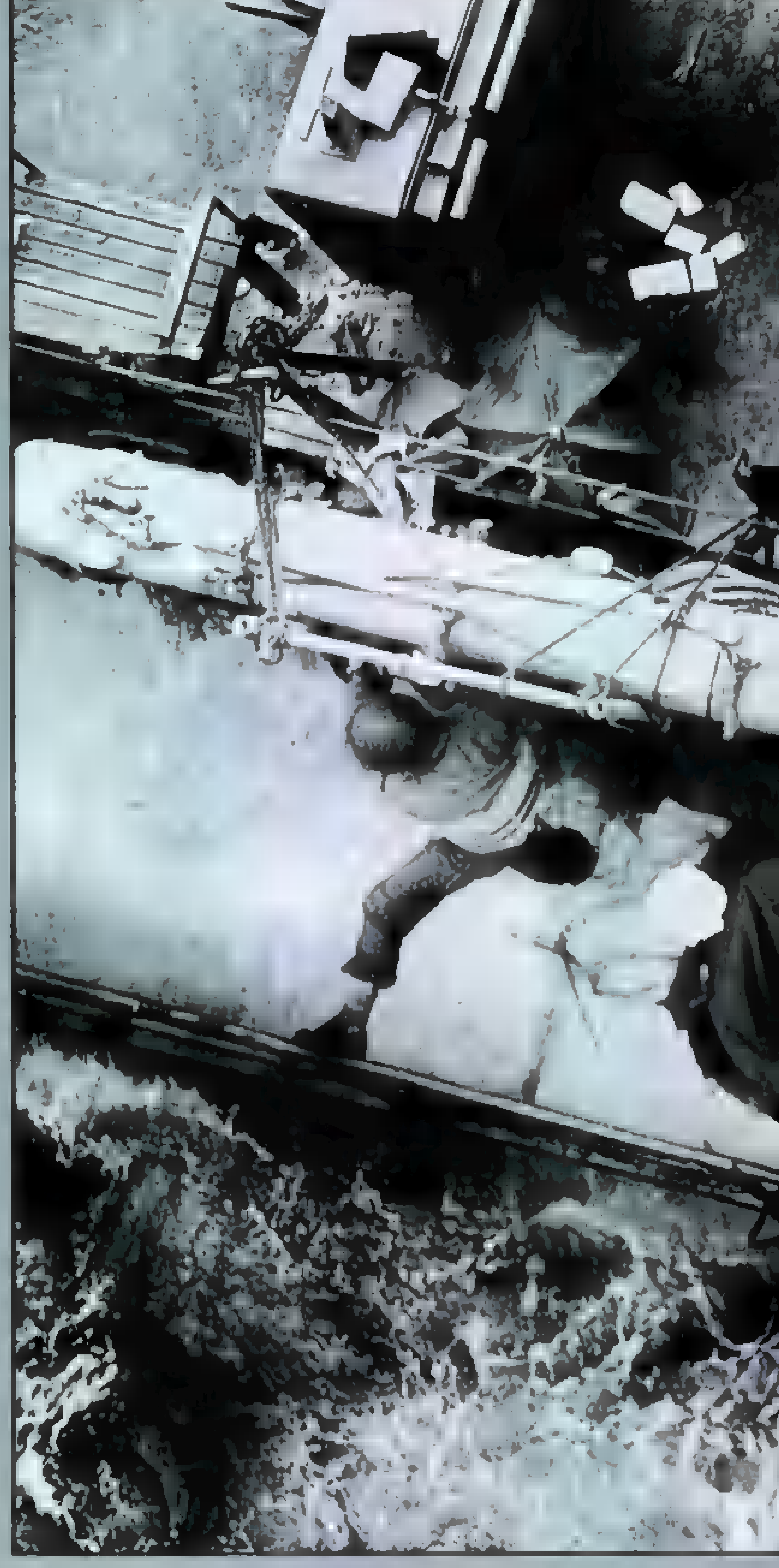
Saving the Living



With her photo and a favorite poster in hand, Evelyn Kowalchuk, veteran of the Army Nurse Corps, looks back to a day after D-Day: She is a flight nurse winging in on Omaha Beach. As German planes strafe the site, she takes off with 24 wounded ("head wounds, stomach wounds, amputees") destined for hospitals in England. "It happened in minutes and was very orderly," she recalls. A doctor had triaged them, so those expected to die were left behind.

At sea countless men survived because of Coast Guard crews' seamanship. Delba Nivens, coxswain at the helm of a burning, bullet-riddled landing craft (facing page, bottom), got his men ashore. Crewmen put out the fire, and the craft went back to the transport *Samuel Chase* for another load of troops. Lt. Coit Hendley, his vessel shattered by a mine when he landed men on Omaha, managed to get dead and wounded to a transport (right) before his crippled ship capsized and sank.

Among wounded men on Omaha awaiting evacuation (below), Sixth Naval Beach Battalion sailor John Gallagher, his face covered in bandages, was later given up for dead. He's still alive—and his body carries so much shrapnel that he says, "I try to stay away from magnets."



O. LOUIS MAZZATENTA (TOP LEFT), NATIONAL ARCHIVES

mine. Clyde grabbed the flag, jumped off the wreck, and headed for another bulldozer, whose driver had been shot in the head. Clyde removed the body and headed up the beach. Then an artillery shell smashed that bulldozer. Still clutching his flag, Clyde sprinted toward an abandoned bulldozer, got in, and drove off. By the end of the day, Clyde was on his fourth bulldozer and still doing his job—clearing the way for the infantry.

When landing craft *88* beached, Joe Vaghi was the second man down the ramp. The first was a Coast Guardsman in bathing trunks and a helmet. He jumped into the sea to string a line for men to hold onto as they waded in. A German artillery shell hit him, and according to a witness he "disintegrated." Men of the

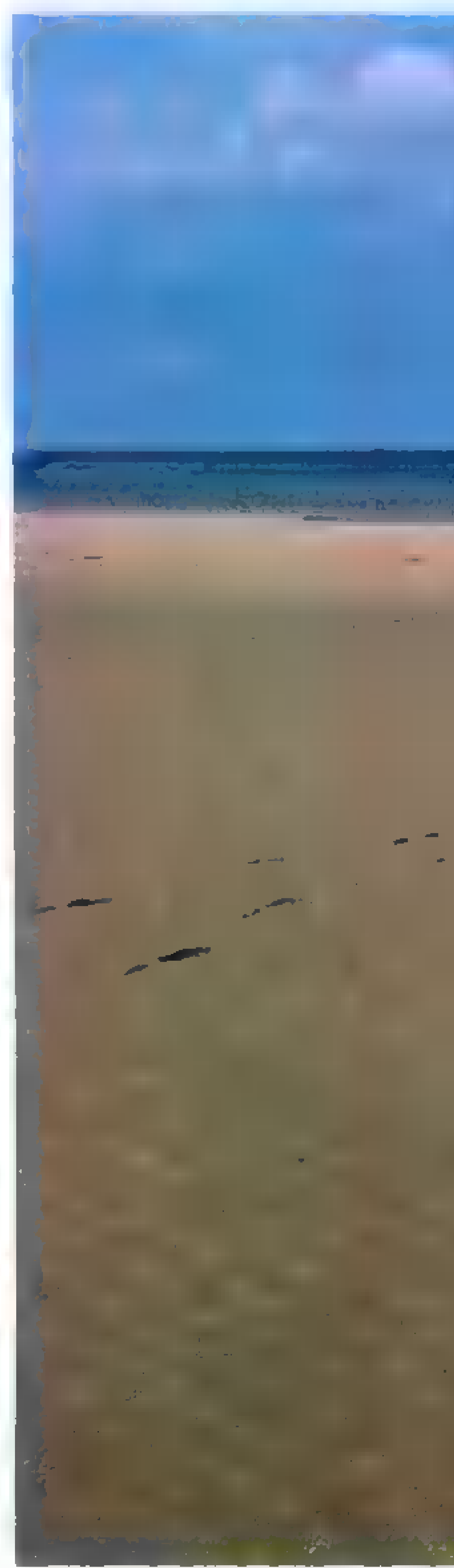
Sixth Naval Beach Battalion—they called themselves "fighting sons of beaches"—began to charge down ramps lowered from both sides of the bow. Another German shell smashed into the starboard ramp, killing two more Coast Guardsmen.

German Pfc. Hein Severloh was crouching behind a machine gun at Widerstandsnest 62 and watching rows of men on the ramps of a landing craft. "My order," he recalls, "was to get them when they were still in one line, one after the other, before they started spreading. So I did not have to swing my gun sideways." Severloh later wrote that he saw "how the water sprayed up where my machine gun bursts landed, and when the small fountains came closer to the GIs, they threw themselves down.... Very soon the first bodies were drifting in the waves of the rising tide.... In a short time, all GIs down there were shot."

Severloh estimates that he fired 12,000 rounds from his machine gun and 400 from his carbine. But the Americans kept coming, and at the end of the day, Severloh surrendered, hoping the Americans would not know he was the German who had fired what was probably the deadliest machine gun on Omaha Beach. Sometime that day, Sgt. Valentin Lehrmann died gazing at a picture of his wife. By late afternoon Widerstandsnest 62

Utah Beach, D-Day, 1944: Bill Kelley is one of 20,000 men who storm this shore, take the beach, and help to liberate Europe. Utah Beach, D-Day, 2001: Bill Kelley walks with his grandson Jake, who listens [illegible] Grandpa's [illegible] takes him through France, into the Battle of the Bulge, across the Rhine to victory in Europe. "And I got home in one piece," says Kelley.

William Bostick, whose map drawings helped guide U.S. craft to the beaches, landed at Omaha on June 7. "I counted about [illegible] thousand dead soldiers and sailors," he recalls. On the spot, he captured the moment in a sketch (left), paying homage to the fallen heroes of D-Day.



was empty, all its men dead, wounded, captured, or running for their lives.

In the sea, men also died. As another landing craft, *85*, beached at Easy Red and struck a mine, German machine guns and artillery zeroed in. "The shells tore into the troop compartments. . . . They smashed through massed men trying to get down the ramp," the captain later reported. Ablaze and riddled, she backed off the beach, carrying a cargo of dead and wounded. Her crew transferred all able-bodied survivors to other landing craft heading for Omaha. Her doctor helped with casualties, then boarded a boat for the beach to tend to those dying in the surf and on the sand.

What scenes we know on Bloody Omaha live on in the memories of men like Joe Vaghi—the brave but unsung troops who soldiered on and won the war, along with the forgotten sons of beaches who were both sailors and soldiers.

There is also the scene recorded by one of the BIGOT artists, Lt. William Bostick. On June 7, the day after, he walked the shore he'd seen for months in his imagination and watched soldiers digging temporary graves for bodies carried up from the sands. Then he drew one more sketch, a study in pen and ink that rendered the high price of human liberty. He titled it, "Burying the Dead on Omaha Beach." ◻

MORE ON OUR [illegible]

Contribute to a D-Day Memory Book, listen to survivors, including Joe Vaghi, and find more resources at **nationalgeographic.com/ngm/0206.**

ALEXANDRA BOULAT (ABOVE); WILLIAM BOSTICK

The National D-Day Memorial rises in a small Virginia town that gave so much.

Saluting the Troops

MEMORABILIA FROM THE COLLECTION OF LUCILLE H. BOGGESS

By CLIFF TARPY
NATIONAL GEOGRAPHIC SENIOR WRITER
Photographs by
O. LOUIS MAZZATENTA

In the hell that was D-Day, many soldiers wept. Cyril Leuelling wasn't one of them. But during last year's dedication of the National D-Day Memorial in Bedford, Virginia, tears welled as Leuelling (right), who was an infantry staff sergeant, recalled the carnage on Utah Beach. "We got hit with mortars, artillery, and small-arms fire," he said. "Six or seven men fell around me."

Loss became all too familiar in Bedford. The southwestern Virginia town was chosen as the memorial site because it is believed to have suffered the most D-Day fatalities per capita of any community in America—19 out of a population of less than 4,000. Among the town's dead were the Hoback brothers (photographs at left)—Raymond, far left, and Bedford, both infantrymen. In a group photograph Bedford kneels with his fiancée, Elaine Coffey, before shipping out. The brothers

COMBAT
V.E.T.
ARMY
W.W.II
"SGT"
LEUELLING

died storming Omaha Beach, Bedford was buried in France. Raymond's body, presumably washed out to sea, was never recovered. But a soldier found Raymond's Bible and mailed it to his family. "On Sunday, July 16, the sheriff brought the telegram telling us of Bedford's death," his sister Lucille Boggess recalled. "On Monday my sister and I tried to cheer up our folks by making ice cream. We were in the basement turning the handle when the second telegram came."

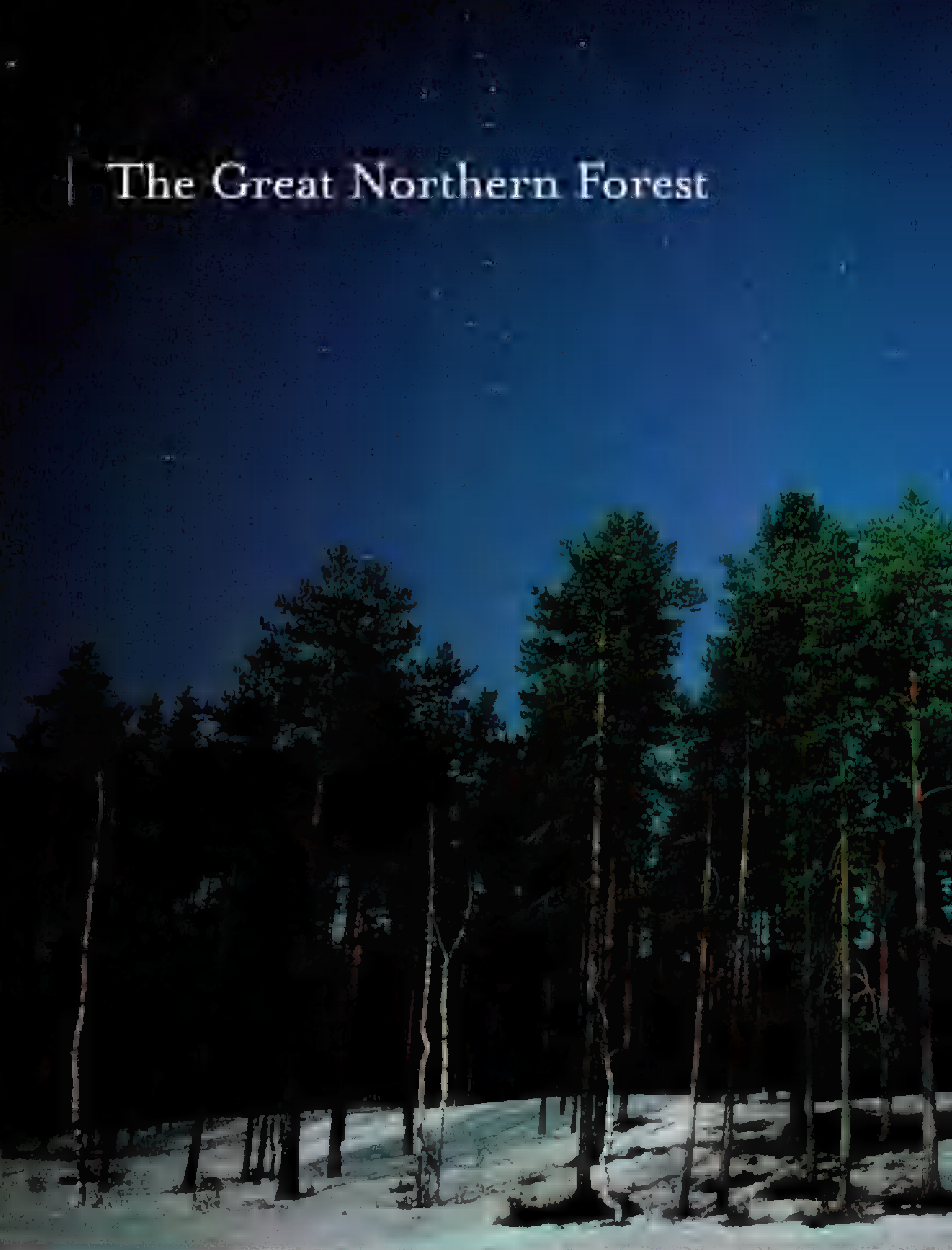
A crowd of 21,000 gathered for the memorial's dedication on June 6, 2001—57 years to the day after the D-Day landing. Rising 44 feet, 6 inches, an arch symbolizes the June 6, 1944, invasion date. Its black-and-white cap replicates the stripes used on Allied aircraft for D-Day. Below, statues of soldiers storm a concrete "beach" containing sand from Normandy. Beyond fly the flags of the 12 nations that cooperated in the invasion. At the dedication President George W. Bush laid a wreath and lauded the "scared and brave kids by the thousands who kept fighting" on the beaches of Normandy.

At his Bedford home Price R. Stanley (below) holds a picture that he believes shows him, foreground, marching to Saint-Lô, France, a month after D-Day. "I remember a flash that must have been a flashbulb. And that's the way I carried my raincoat and machine gun," he said of the photo, which appeared in a history of his 29th Infantry Division. Stanley escaped injury on D-Day but was wounded later and sent home.

Roy Stevens of Bedford (bottom right) holds a picture of his twin brother, Ray, who was killed on Omaha Beach. "We were in the first wave of the assault," Stevens recalls. "We rode

in different landing craft. I think Ray was hit by machine-gun fire. My boat struck a metal pipe put there by the Germans, and it sank in 20 minutes." Stevens paddled onto an Allied weapon called a Bangalore torpedo, which, like him, wore a flotation belt. He hung on until he was picked up and flown back to England. Days later Stevens returned and found Ray's temporary grave. "I looked down and asked myself, 'Why him and not me?'" □

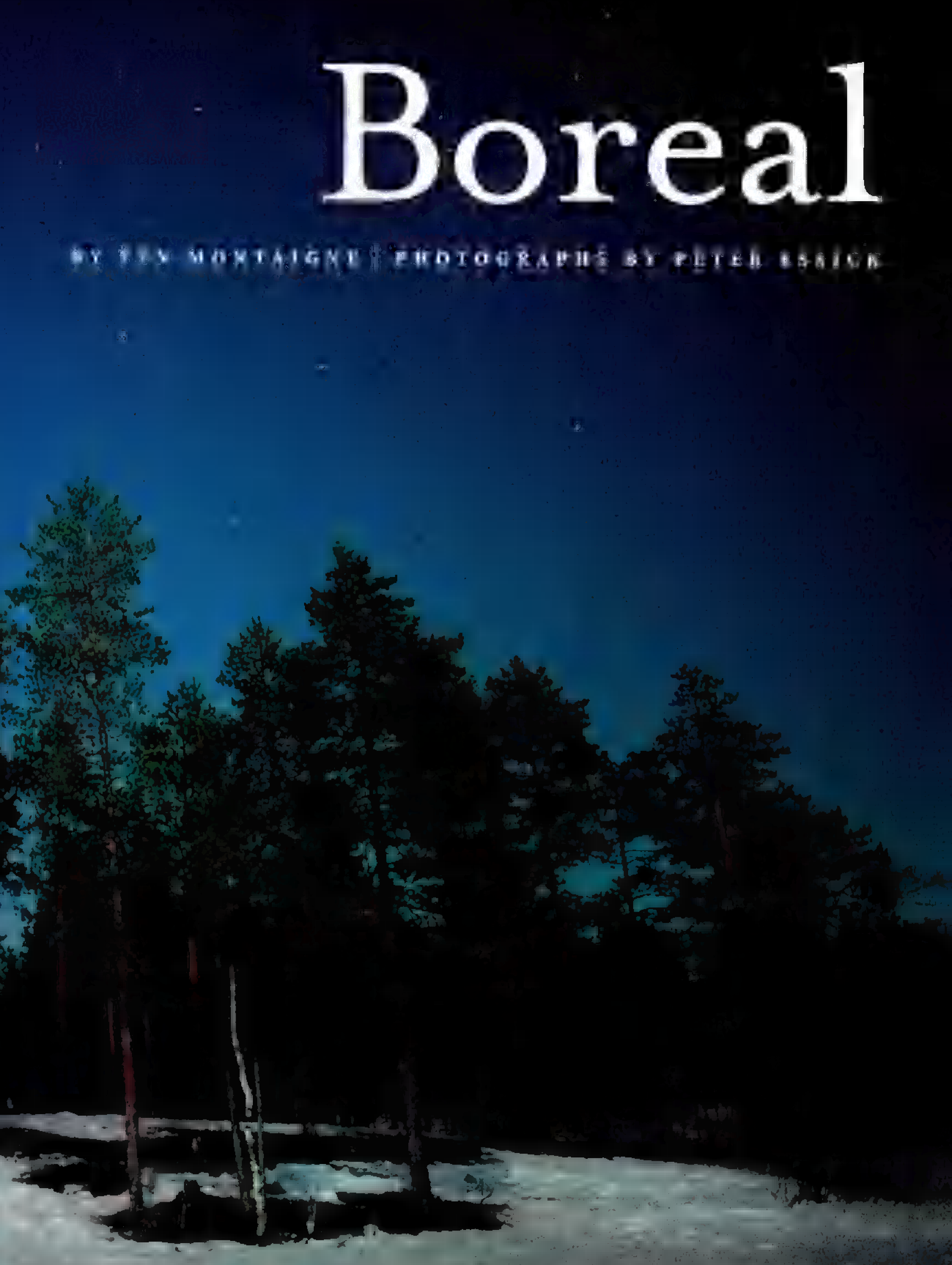
▶ Planning a visit to the National D-Day Memorial? Find travel information online at nationalgeographic.com/ngm/0206.



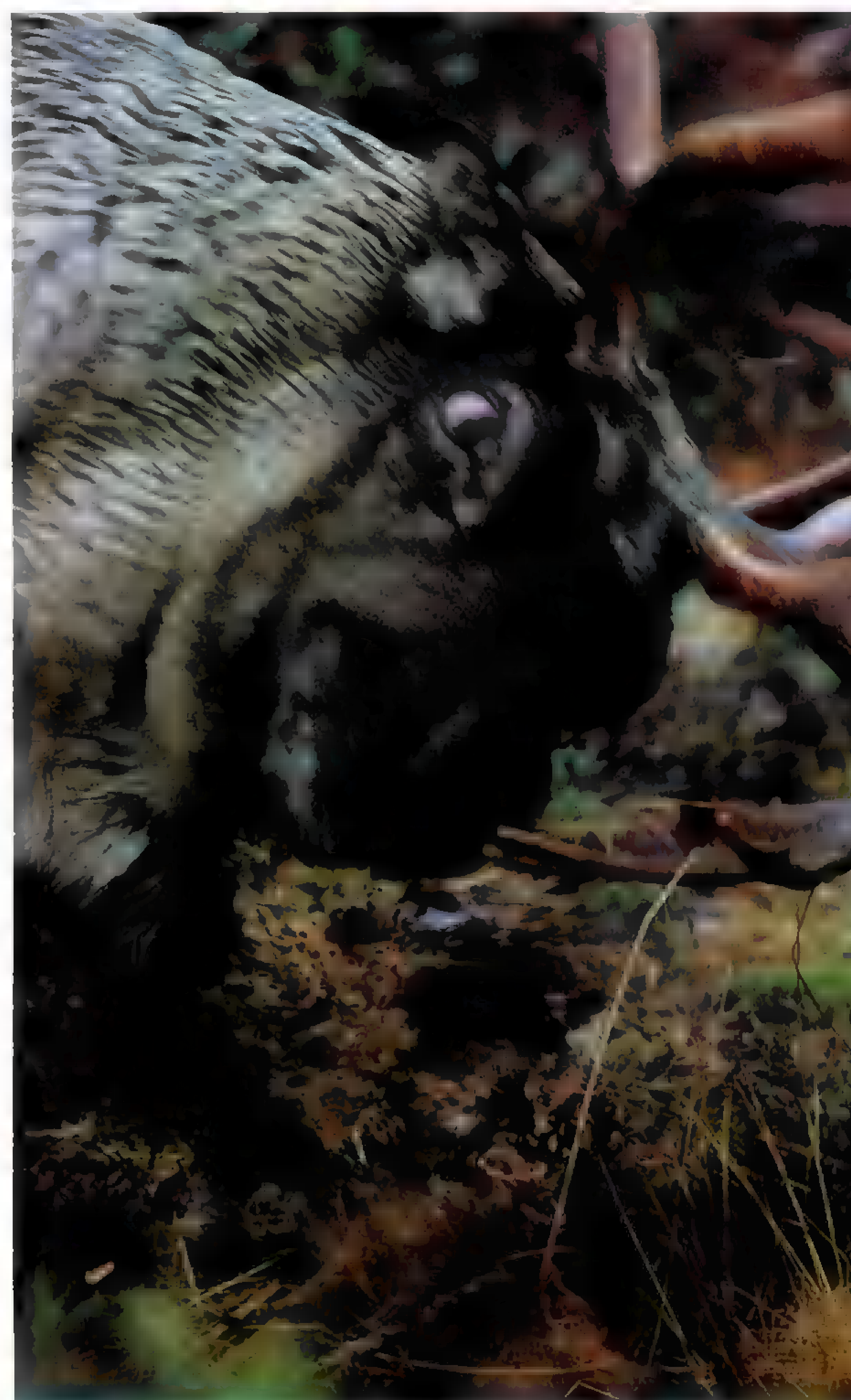
The Great Northern Forest

Boreal

BY FEN MONTAIGNE | PHOTOGRAPHS BY PETER ESSICK



Slow-growing and slender, conifers reach toward starlight in Russia's Kareliya Republic. This is boreal forest—the great globe-circling ecosystem of the north—where soils are thin, growing seasons brief, and plants, animals, and people must all withstand constant change.



Reindeer in Sweden's far north lock horns in a fall contest for breeding rights. The Sami people of Scandinavia built their culture around these animals. The reindeer in turn depend on old-growth forests to produce lichens, which nourish them through long winters. Traditionally the Sami prospered when the forest did.

Several small huskies trotted jauntily down a dirt road in the western Siberian taiga, heralding the presence of the Moldanov clan. The dogs were followed by two men, one carrying a shotgun, then three women wearing flower-print head scarves and brightly colored dresses hemmed with embroidered strips of cloth. All were bent under the weight of sacks and birch backpacks filled with gleanings from Russia's boreal, or northern, forest—fish, berries, and reindeer meat.

It was a mild afternoon in early September, and Oleg Moldanov and his family—members of an aboriginal group known as the Khanty—had left their home deep in the woods to pick the cranberries growing in profusion across the landscape. I had spent two days chasing phantom reports of Khanty still pursuing a subsistence life in this area of burgeoning oil and gas development. Finally, on the northernmost frontier of oil drilling in the Surgut region, a tip from oilmen led two Russian scientists and me to the Moldanovs.

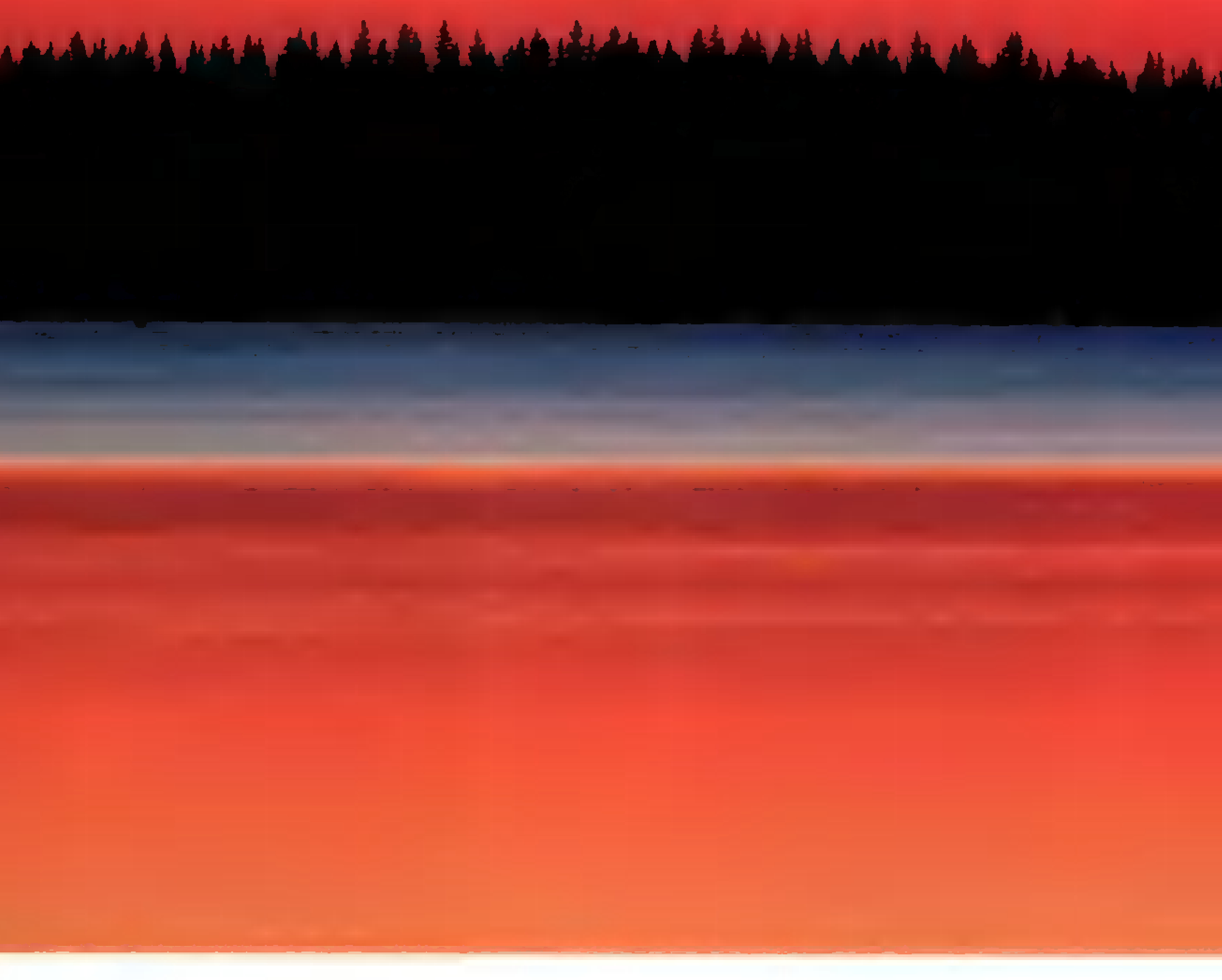
A short, tawny-skinned man dressed in black, Oleg invited the three of us to watch his family set up their temporary fall camp. It was located in a tidy pine grove, devoid of understory and carpeted in a layer of cream-green lichen that put me in mind of a nap. As Moldanov's huskies yapped at a squirrel high in a tree, the family dropped their loads, lit a fire for tea, then wrapped a 12-foot tepee frame in khaki-colored canvas. The forest floor was littered with pinecones bearing sweet nuts that the squirrels, and the Khanty, would dine on all winter.

After tea and bread, Oleg, 47, and his 26-year-old son, Gennady, escorted us a few miles to their permanent home in the taiga. Along the way we moved swiftly through a dark forest, ducking under low-slung branches. Much of the woods was boggy, forcing us to hop from clump to clump of springy sphagnum moss. Crossing a narrow river, we pulled a half dozen pike and a dozen whitefish from nets, then plunged deeper into the taiga, through a checkerboard landscape of peat bogs and pine groves. In one stand Gennady showed me his wooden traps for bear and capercaillie, a large black grouse. That meat, along with moose, squirrel, ptarmigan, waterfowl, fish, and a herd of reindeer, is sufficient to feed the family. Indeed, for all its frigidity, the boreal forest is a bountiful place that has produced enough food and fur to support the aboriginal people of Russia, Canada, and Scandinavia for millennia.

After crossing a fen whose low shrubs were just beginning to turn salmon pink, we at last came to the Moldanovs' place, a collection of several ash-colored log buildings and a reindeer corral. Set in a clearing on a small lake, the compound is miles from the nearest oil well and is a place of absolute stillness.

It was 6:30, and the trees around the homestead were going gold in the rays of a lingering sunset. I surveyed the lake and surrounding bogs, my appreciation heightened by the knowledge that it was an island in a spreading sea of development. As the Moldanovs and 23,000 other Khanty are being squeezed into ever diminishing swaths of taiga, their traditional way of life is slowly disappearing.

"I was born far away, in Noyabrsk," Oleg said, referring to a town 125



Air and water turn molten, and trees retreat into bristling shadow at sunset on Manitoba's Cross Lake. "The beauty of the boreal landscape is at the heart of Canadian identity," says conservationist Don Sullivan. "It's a commodity every bit as valuable as timber and hydropower, and it's vanishing from Canada."

miles to the northeast. "There were geologists all around, so we came here 30 years ago, when there were no Russians. Now there is nowhere else to go. There are geologists everywhere."

As the sun sank, Oleg and I set off on the return trip at a fast pace. Soon we lost sight of the Russian scientists. "Maybe we should wait for them," I said. Only half joking, Oleg replied, "Let them get lost and wander around. There are plenty of Russians."

Circling the globe, the boreal forest—its name derived from Boreas, the Greek god of the north wind—comprises one-third of Earth's wooded lands. Half the boreal forest is in Russia, while Canada has one-third, and Alaska and Scandinavia the rest. The forest begins where the temperate woods of oak and maple disappear and continues north, often past the Arctic Circle, until stunted larch and birch trees peter out to treeless tundra. With long, cold winters and short, cool summers, the boreal woods have far less biodiversity than tropical forests—Canada has 3,270 plant species compared with Indonesia's 29,375—and are defined by a few key tree species: spruce, pine, fir, larch, birch, and aspen.

If the tropical forests, which contain half the planet's woodlands, are one lung of the Earth, then the boreal forests are the other. Both play a

Alberta's forest seems endless from the air, but in 1999 Canada's Senate declared, "We're cutting too many trees over too large an area" —nearly two million acres each year. Urging dramatic expansion of protected areas, senators warned that "the window of opportunity for preserving . . . the boreal forest is closing rapidly."

vital role in regulating climate as they—along with the ocean, Earth's largest carbon repository—filter out billions of tons of carbon dioxide and other greenhouse gases during photosynthesis, storing the carbon in trees, roots, and soils. But in many ways the boreal forest is the forest the world forgot. Over the past two decades, as the public focused on the destruction of the tropical forests, few looked north to woodlands nearly as vast. That's because tropical forests have been under a full-scale assault—an area twice the size of Florida is lost every year to farming or other activities—while the boreal forests are still relatively intact. Remote and sparsely inhabited, more than half the boreal in Russia and Canada remains essentially untouched.

Still, as my travels in these countries showed, logging, oil and gas drilling, and flooding from hydropower dams are gnawing away at the boreal. Such development is eradicating older forests, harming birds and wildlife, and eroding the traditional subsistence way of life of people like the Khanty. A damaged and diminished forest is also much less able to withstand the changes brought on by global warming. A related increase in fires could also throw an immense, climate-stabilizing system out of whack, causing the boreal forest to produce more greenhouse gases than it absorbs, which, in turn, would likely accelerate global warming.

The intensifying exploitation of the boreal forest, coupled with fears about the effects of global warming, has rallied conservationists, who are campaigning to set aside extensive wild tracts of the north woods. "In terms of maintaining a vast, healthy forest ecosystem, the boreal offers us our last big chance to do it right," said Stewart Elgie, executive director of the Canadian Boreal Trust, a nonprofit conservation organization.

I came to know the world's largest boreal forest through years of work in Russia, journeying from the taiga's heavily logged southern fringe on the Chinese border to beyond the Arctic Circle. There, following aboriginal reindeer herders, I traveled through the zone where the forest fades away, with gnarled larch trees pushing the limits of existence. Though only 20 to 30 feet tall, some are more than 500 years old.

Manitoba's forest is pantry, pharmacy, and home to Garry Raven. The Anishinaabe elder struggles to keep his people's way of life from falling through Canada's bureaucratic cracks. Federal law protects native rights to hunt, fish, and gather plants on public lands, but the provinces control logging in those same areas.

I had also been to the tropical forests of South America, where there is more of everything—more trees, more animals, more insects, more tumult. But I prefer the understated charms of the boreal, with its limitless expanse of lakes and ponds and its gentle gradations of green: the pale hues of the reindeer lichen, the black-green of the spruce, the lighter, almost chartreuse tints of aspen and birch. More than anything, perhaps, I am partial to the light of the north woods—slanting rays that in the warmer months cast long evening shadows and suffuse the landscape with a crystalline glow.

On just such an evening in early June I found myself in Alberta's boreal forest with Richard Thomas, a bird expert and author of a government report on the fragmentation of the province's north woods. We were in Sir Winston Churchill Provincial Park, easing our way down a path in a dusky grove of birch, balsam fir, and white spruce, several nearly three feet in diameter and towering 90 feet overhead. In places the forest floor was an orderly tableau of ferns, moss, and piles of shredded pinecones left by squirrels. In other places it was an impassable tangle of blown-down trees, their collapse clearing a hole in the canopy, allowing light to nourish new growth. On a rotting "nurse log," saplings had begun to grow. The air was perfumed with the scent of balsam fir.

Earth's Green Crown

A single ecosystem rings the north, shaped by fire, Arctic weather fronts, and the movements of long-vanished glaciers. Says boreal activist Don Sullivan, "You could walk across Alaska and Canada, Scandinavia and Siberia, and always be in the same forest."

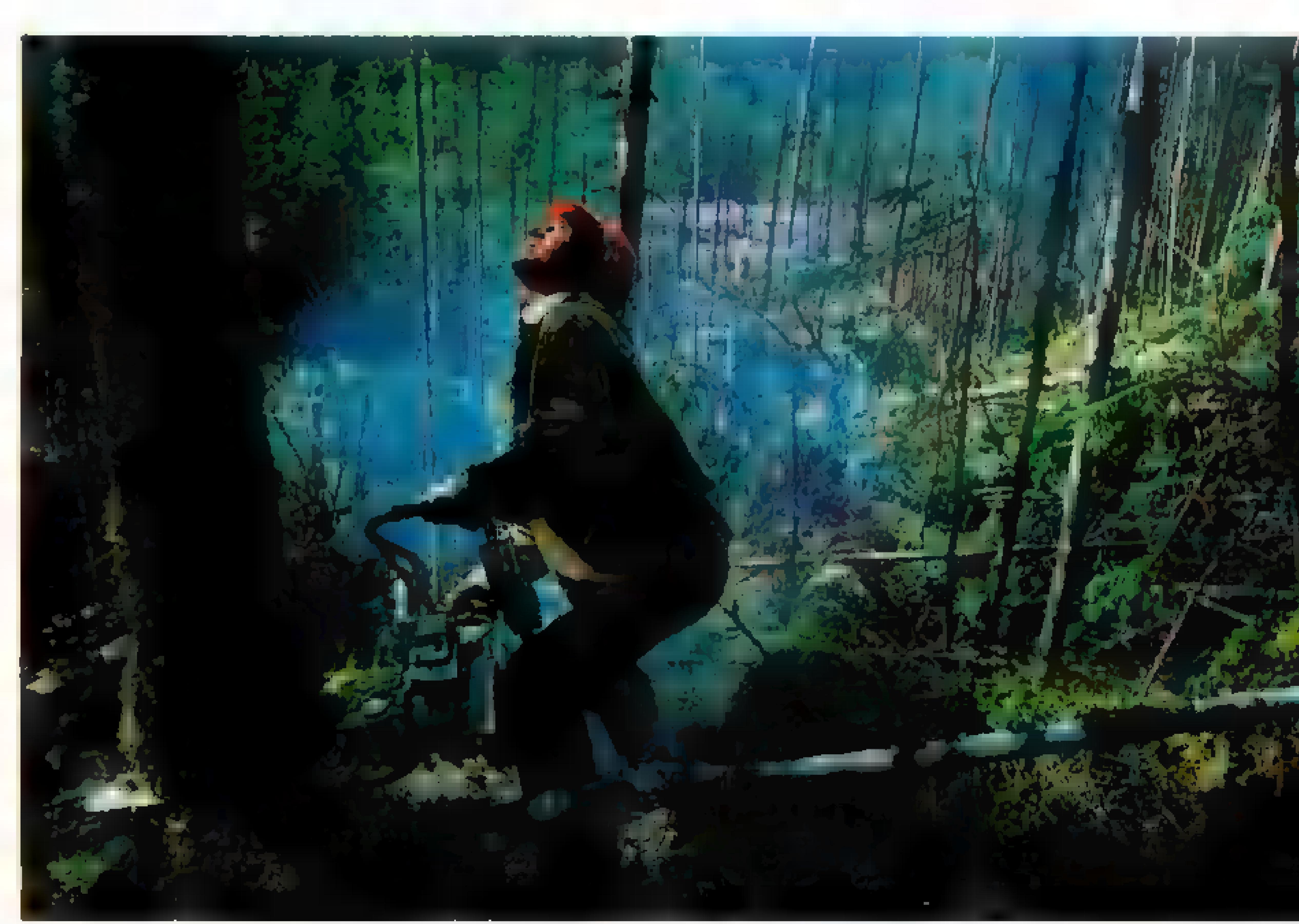
WITH LOGGING RIGHTS to 14 million acres of forest in northeast Alberta, an Alberta-Pacific Forest Industries mill (below) produces more than half a million tons of pulp each year. New technologies allow the mill to bleach pulp (for papermaking) without using chlorine and have significantly reduced wastewater and chemical discharges.

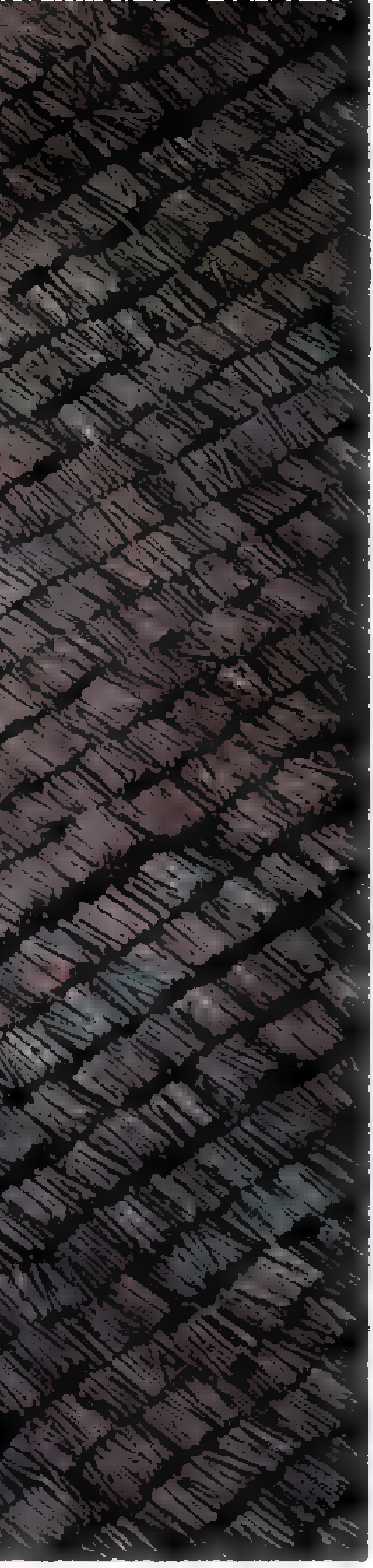
ASPEN AND SPRUCE will regrow in a burned forest (bottom), but how will climate change affect that growth? University of Alaska graduate student Jill Johnstone studies seedlings in a greenhouse enclosure that mimics the warming many scientists predict may raise temperatures by two to six degrees F in Alaska's interior over the next century.

INDUSTRIAL FORESTRY has fragmented much of the world's boreal forest, but vast tracts that have evolved for millennia remain unexploited. "These landscapes," says U.S. Forest Service ecologist Marilyn Walker, "are on a scale that allows us to see how complex forest systems work without human interference."

FOREST DATA: WORLD WILDLIFE FUND; WORLD CONSERVATION MONITORING CENTRE; WORLD RESOURCES INSTITUTE
NATIONAL GEOGRAPHIC MAPS

Feeding the global paper appetite chews up trees at an almost incomprehensible rate. Manitoba's Pine Falls log yard (above) can yield 193,000 tons of newsprint annually, using just a fraction of the 6.8 million cubic yards of timber that its owner, Tembec Industries, harvests from Canada's public lands each year.





The land and the logger are Russian, but the profits belong to Rimbunan Hijau, a Malaysian conglomerate with a long-term lease on 914,250 acres of Siberian forest. Local communities want jobs, but officials have blocked construction of timber roads that would disrupt the habitat of endangered Siberian tigers.

"Can you hear that slurry sound, that liquid call note?" asked Thomas, 50, whose brown hair fell to his collar. "That's a Swainson's thrush. They're a bird that likes the gloomy habitat of the forest interior."

Thomas and I walked slowly, the Welsh-born scientist noting the dead, gray trunks pocked by pileated woodpeckers, the sound of beetle larvae chewing on the inside of a tree, and the calls of white-throated sparrows, yellow-rumped warblers, and red-breasted nuthatches. Many of the species we heard, and less often spotted, are the migrants that winter in Central and South America and return to Canada's boreal forest to breed.

"With all these old trees and snags, there's a lot of structure and diversity here," said Thomas. "There are many niches for birds and animals." Although he is a boreal aficionado, Thomas acknowledged that the forest is underappreciated. "With the Rockies you get fantastic scenery, and on the Pacific coast you get spectacular forests. But the boreal forest is more subtle. It takes more effort to appreciate. With the boreal you have to be patient. And because it's subtle, the boreal forest doesn't get the respect it deserves."

That rarefied beauty was on display two days later when we visited a fen where nine varieties of orchids were growing. Leaving a gravel road, we hiked down into a forested wetland where clusters of light gray lichens clung to the dead branches of black spruce. Cold, dark water filtered through the fen, underlain by permafrost—a fact that became evident when I took a walking stick and, plunging it through the moss, hit a frozen layer with a thunk. Scattered throughout the fen were delicate, quarter-size white and yellow orchids supported by waxy green leaves.

"The key to the boreal forest is the interconnections between the forested area and the wetlands," Thomas said. "It's a mosaic."

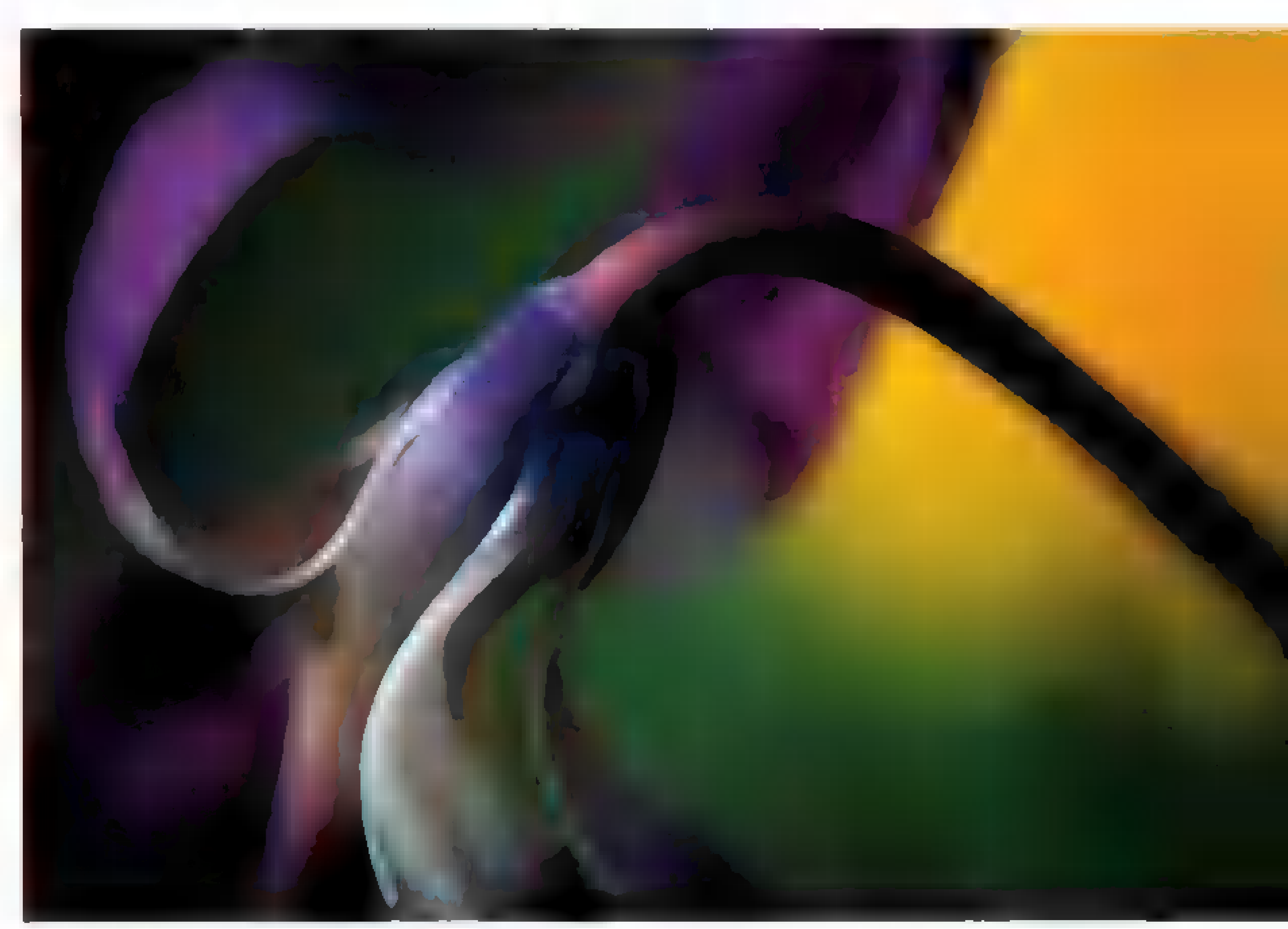
Water and fire have shaped the north woods. The boreal forest has the largest area of wetlands in the world, with Russia and Canada each containing an estimated one to two million lakes and ponds. Yet an ecosystem with so much moisture is, oddly enough, highly susceptible to fire, for compared with tropical forests the boreal zone receives only moderate amounts of rainfall. Fire, set by lightning or man, is the main regenerator of the forest, and in Canada and Russia today immense blazes often destroy as many trees annually as logging. After the fires comes rebirth—the larch and aspen popping up first, often followed by pine, spruce, and fir.

A third force is now shaping the boreal—resource extraction—and Alberta is a prime example of its deleterious effects. The volume of logging in Alberta has increased tenfold since 1960, when 96 percent of the province's boreal forest was essentially wilderness. Today, after an oil and timber boom spurred by the United States' appetite for natural resources, the situation has reversed, with less than 10 percent of the province's boreal forest existing in swaths larger than a few square miles. The forests are crisscrossed by an estimated half million miles of roads, pipelines, and 15-foot corridors used for seismic testing for oil and gas deposits. One massive deposit of oil mixed with sand underlies northeastern Alberta's forests, where vast open-pit mines now cover more than 120 square miles. As many as 15,000 people have recently been employed in oil sands projects, which helps explain why few Albertans have protested the bonanza that has altered their economy and their landscape.

The effects of all this are now beginning to come to light. A nine-year study by University of Alberta researchers has documented a 20 to 50

Human tracks rarely cross Russia's Kostomukshskiy Nature Reserve along the Finnish border. Only scientists and visitors with special permits may enter, leaving 117,600 acres of pine woods and wetlands to flourishing populations of moose, reindeer, weasels, otters, wolves, bears, eagles, and swans.

Brushstrokes of violet tint the petals of Russia's candyk *flower. Though sturdy enough to survive on wooded slopes at elevations above 9,000 feet, this lily family member is endangered in the wild. Along with 1,500 other vascular plant species, it is protected within the two-million-acre Altayskiy Nature Reserve.*



A carefree swing from a birch tree belies the concerns many Russians like Lena Petrova express for their environment's future. Two years ago, in a cost-cutting move strongly criticized by conservation activists, President Vladimir Putin abolished Russia's national environmental protection and forestry agencies.

percent decline in some migratory bird populations in fragmented forest areas, probably because of habitat disturbance. Big mammals also have suffered as their habitat has been whittled away. In the Swan Hills region of central Alberta the population of grizzly bears has dropped from about 400 to 80 in the past half century.* Woodland caribou, which need large tracts of forest and eat lichens found in older stands, are in decline, with some herds on the verge of disappearing.

Smack in the middle of what some call Alberta's "fragmentation frontier" is Dave Donahue, a gray-bearded, blue-eyed man of 59 who has been a trapper in the province since 1974. One evening I joined Donahue at his one-room trapping cabin in a forest clearing. He prepared moose and venison on an iron stove, and we ate on his porch, soothed by the rustling leaves of the aspen that surround the cabin. When the breeze quit, however, the whisper of the aspen was replaced by another sound—the faint whir of an oil pump 150 yards away.

For nearly two decades Donahue made a respectable living from his 80-square-mile trapline, riding horses for days at a time into the snowy wilderness, sometimes collecting nearly a thousand pelts a year: squirrel, beaver, mink, ermine, muskrat, sable, timber wolf, lynx, and coyote. "I enjoyed this trapping life immensely," said Donahue, who has a wife and four children. "I know this bush, every bit of it. I enjoyed the solitude."

Things began to change around 1990 when oil companies started hacking out the first roads on the public land he leases exclusively for trapping. Oil drilling intensified, and by the late 1990s three timber companies were also felling trees on his trapline, which now has 55 oil wells and 50 miles of roads. What he no longer has is an abundance of animals. In good years he used to trap 240 beavers annually. Now he gets a mere dozen. He would sometimes bag nearly 600 squirrels but now gets maybe a hundred.

That evening and the next day Donahue took me on a tour of his trapline. Driving down muddy roads in his old pickup, we passed oil drilling sites and numerous clear-cuts where loggers had chopped down aspen to the edge of beaver ponds. The ponds were abandoned, with grass sprouting on top of the beavers' former lodges. Road construction crews had also shot beavers, Donahue said, because the animals' incessant drive to dam culverts often erodes roadbeds.

"Look, they logged right up to this beaver house here," said Donahue. "They don't leave one stick of green wood, and without that food the beavers die right off. Wherever they clear-cut, the ponds dry out because there's no food for the beaver. It turns my stomach to see all this."

On the other side of the world is a man who sees the exploitation of the boreal forest as beneficial, a scientist whose views have been shaped by the enormity of the taiga that spans his native Russia. Vladimir Sedykh is the controversial chief scientist at the Sukachev Forest Institute in Novosibirsk, and as we flew north to the oil fields of Surgut, where he works to restore damaged woods and wetlands, he reveled in the forest's wild expanses.

"Do you see these swamps and woods?" asked Sedykh, a portly 67-year-old who has spent 46 years studying forest regeneration. "There's nothing like this anywhere in the world. The damage from the oil industry is a drop in the ocean, and the benefits from this development outweigh the disturbance a thousand times. There are pollution

*See "Grizz," by Douglas H. Chadwick, National Geographic, July 2001.

problems, and we have to solve them. But there is no catastrophe."

The imprint of the oil industry is everywhere around Surgut. Its forests and wetlands are brimming with roads, pipelines, wells, and pumping stations. We passed hundreds of acres of trees damaged by oil spills or killed by highway construction that dammed fens and flooded the forest. Environmentalists estimate that several thousand square miles of woods and wetlands in western Siberia have been polluted by the industry.

But in a four-day tour, Sedykh—a paid consultant to Surgut Oil and Gas Company—took me to many places where the boreal forest seemed to be coming back to life after being punished by the petroleum industry. Sedykh's personality, like his opinions, had all the subtlety of an ax blow. "I'll show you the forest coming back, and you will completely share my opinion," said Sedykh, driving his point home with a finger poke to the chest. "These environmentalists, these Boy Scouts, who criticize me have no idea what's really happening in the forest."

Stopping at an old pumping station where leaking oil had saturated the ground decades before, I followed Sedykh into the former dead zone. We plunged into a thick stand of 10-to-20-foot pine trees growing robustly in soil still discolored by oil. "I was shocked by the extent of the destruction I saw here 30 years ago," said Sedykh. "But I've been surprised by the way nature has reacted and how well the trees have grown back. The law of the north woods is, the more you destroy them, the stronger they recover."

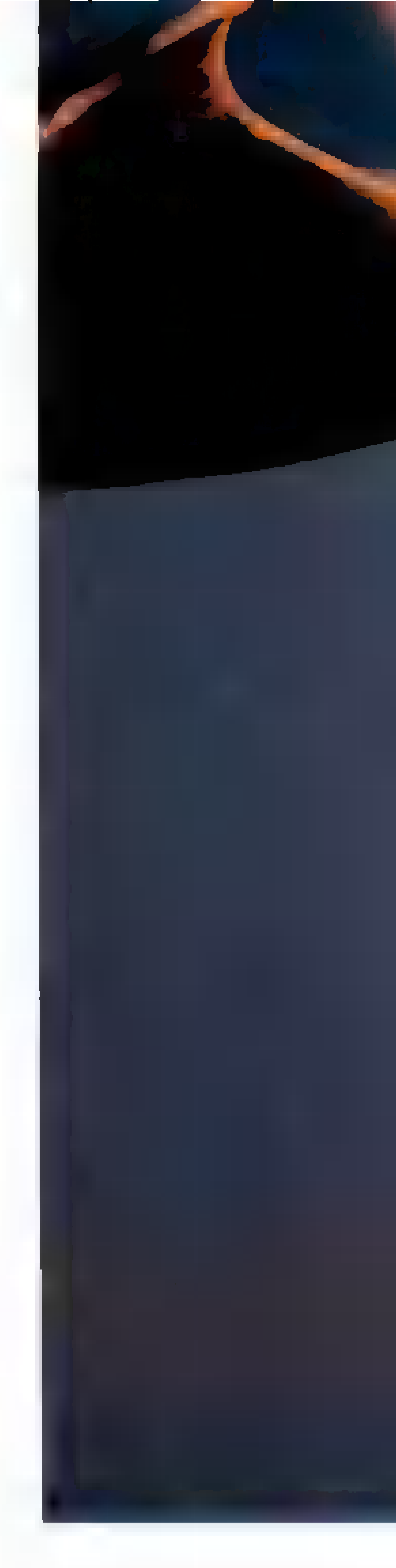
We went on to visit a half dozen of the 220 drilling-waste containment ponds that Sedykh and Surgut Oil and Gas are now recultivating. His solution is to plant cattails in the oily muck, allowing them to soak up the toxins and slowly dry up the pit. He and a team of scientists are also working on environmental maps to help the company locate well sites, preferably away from wetlands. If a spill occurs, Sedykh's solution is simple: "You collect the oil. What you can't collect, you burn. Then you dig up the land, and the forest will regenerate. You'll only get a really healthy forest coming back here with a fire or a bulldozer."

Sedykh contends that if man, imitating fire, strips the forest to bare soil, seeds will find fertile ground, and trees will quickly regrow. In an effort to mimic fire, many timber companies have abandoned clear-cutting, leaving small clusters of trees to hasten regeneration. No one doubts the forest's capacity to renew itself. The key question, then, is: When man—not fire—is doing the damage, how much abuse can the boreal forest take? Sedykh says quite a bit. Others, such as Richard Thomas, argue that the loss of wildlife in places like Alberta shows that the threshold is far lower.

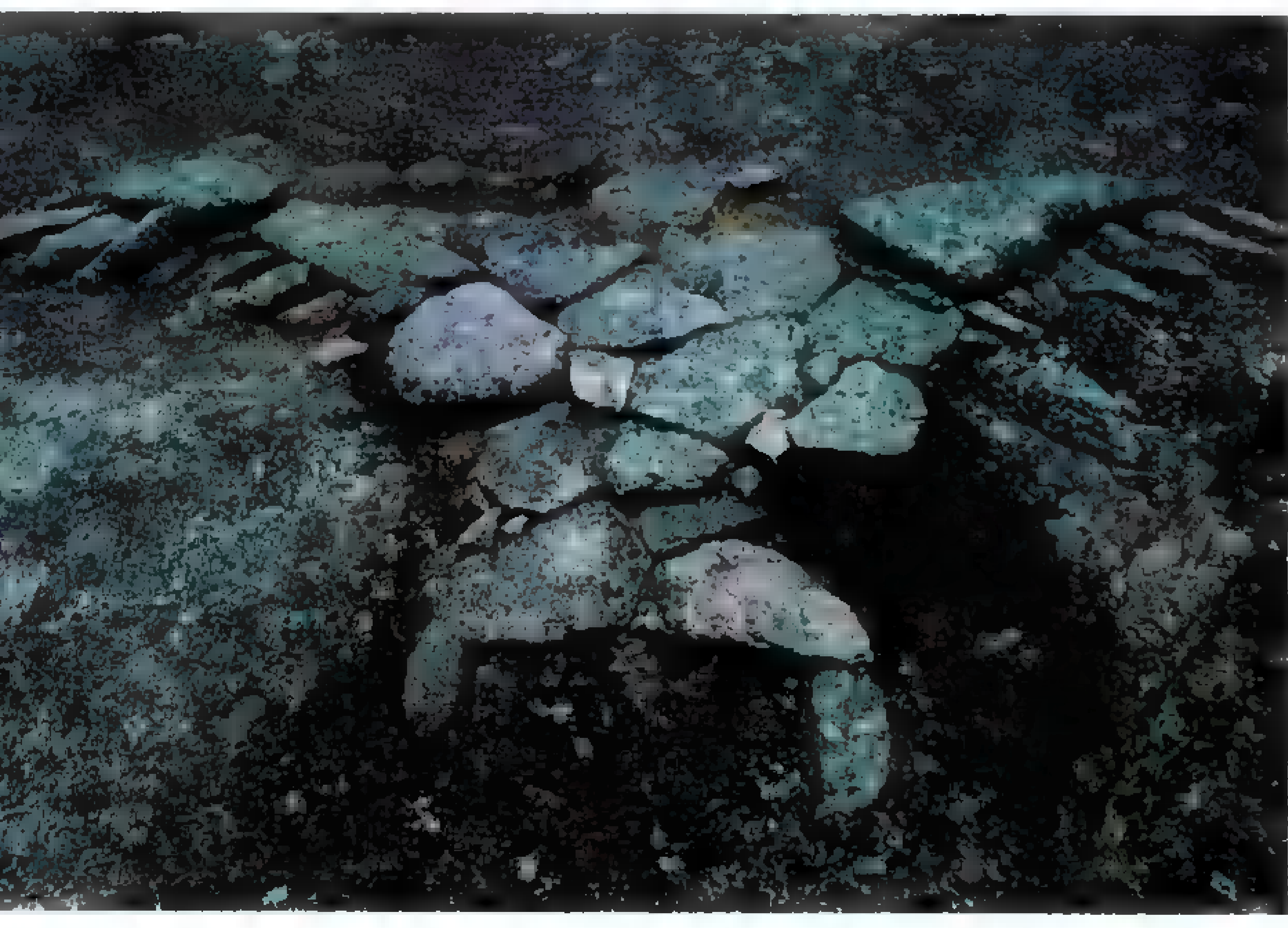
During my last two days with Sedykh, we went to the northern edge of the Surgut drilling zone to collect data on an old spruce-and-fir forest—a site for future oil wells. We followed a small river, passing a muddy patch churned up by a brown bear digging for rodents. To my eyes the woodland was a prime example of mature boreal forest, its tall trees and cool fens harboring all manner of wildlife. But Sedykh pronounced the forest "overmature" and said it needed a good, revitalizing cut.

Walking out of the forest, we crossed a 50-foot bulldozed strip, site of a future pipeline. This time I saw little more than a muddy brown scar, but Sedykh saw rebirth, as evidenced by the hundreds of aspen saplings sprouting up along the sides of the corridor.

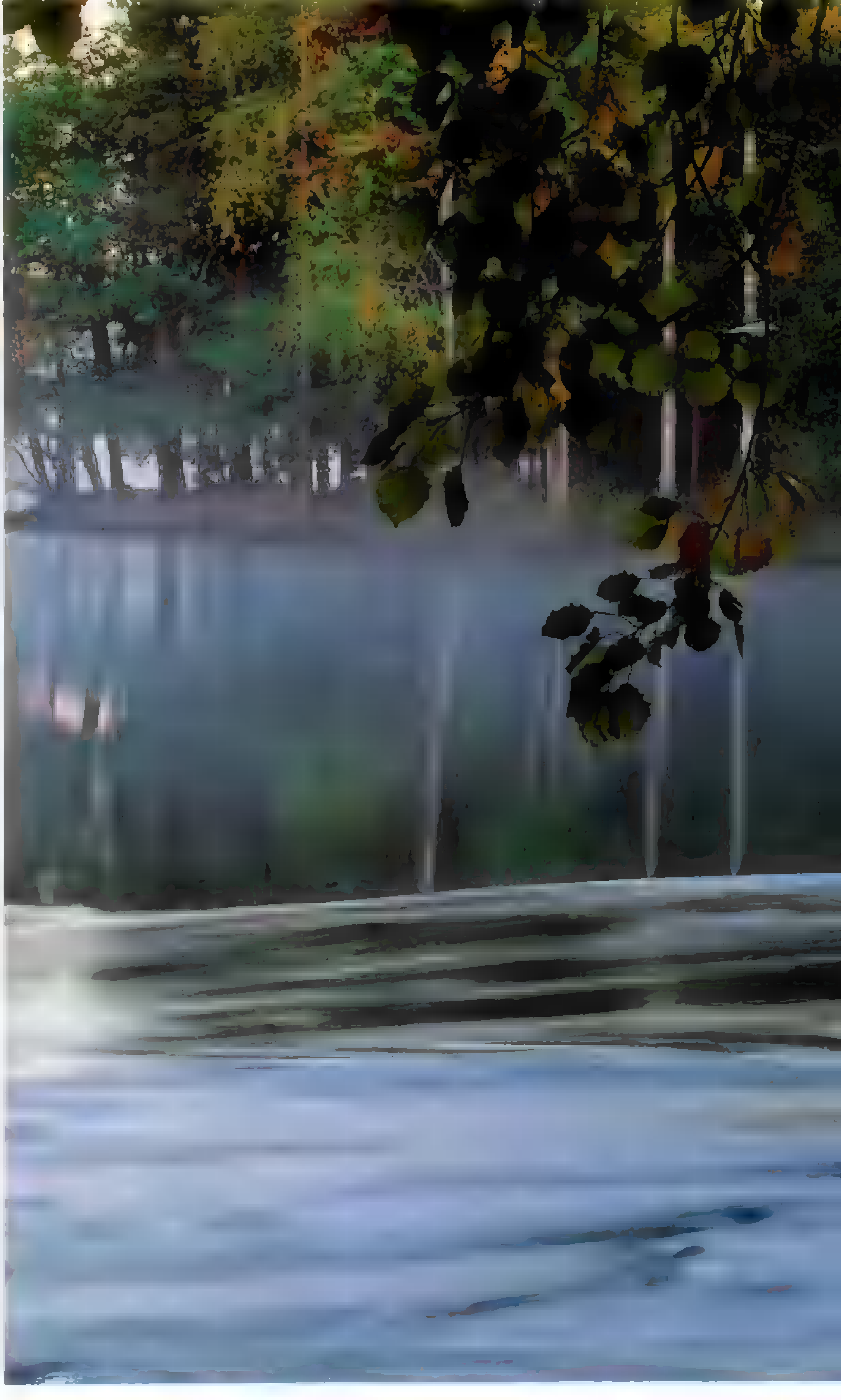
"The world's environmentalists say don't touch the boreal forest—leave it alone, leave it natural," Sedykh told me as we drove south. "But my



Burnished by the setting sun, American white pelicans soar over Lake Manitoba. (A breeding male, at right, has a fibrous horn sprouting from his bill.) Like most of Canada's boreal birds, these are migratory: They fly from the Gulf of Mexico and keep house on northern wetlands from April to September.



A stone eagle spreads lichen-crusted wings over exposed bedrock in southeastern Manitoba. Such artworks mark places that have been part of native peoples' spiritual life for more than a thousand years. To the Anishinaabe, this is sacred ground—the place where the Creator first breathed life into man.



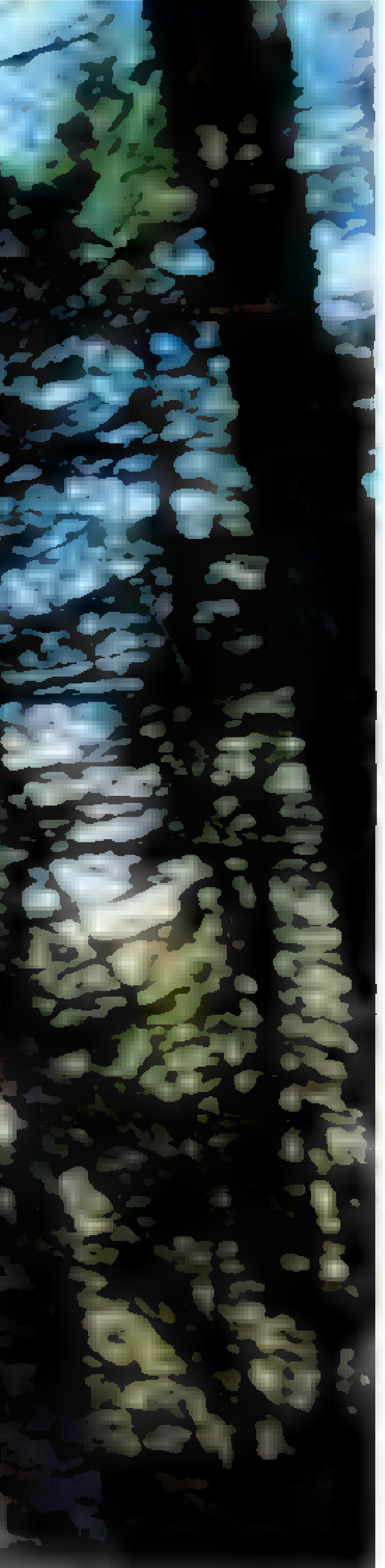
Scattered hints of fall warm oak and linden in Sweden's Färnebofjärden National Park. Northern evergreens meet southern broadleaf trees here in fens and meadows watered by the Dal River. Such ecological border zones support exceptional biodiversity: More than a hundred species of birds regularly nest in the park.

philosophy with the forests is to use them. You want to watch TV, drive a car, live well, right? And how do you do that if you don't touch nature?"

In Russia's Far East, forests reach deep into the lives of native Udege people. Konstantin Komandiga's small yearly harvest of wild Siberian ginseng provides much of his cash income. Massive new logging concessions in the Sukpay region threaten to disrupt such sustainable resource traditions.

Looming over the debate about human interference in the world's boreal forests is an as yet unanswerable question: Will the effects of global warming eventually dwarf man's impact? Mike Apps, a climate change specialist with the Canadian Forest Service, is one of many researchers who fear the consequences of continued warming. "Over the next hundred years I believe that climate change and a shift in weather patterns have the potential to cause more change in the boreal forest than any direct human activity, other than nuclear war," he said. "The scientific difficulty is that some climate change factors cause damage while others enhance forest growth."

One concern is that higher temperatures in the boreal forest—which stores about 30 percent of the carbon found on the Earth's land surfaces—will speed the decomposition of peat lands, forest litter, and layers of permafrost, leading to a large release of carbon dioxide and methane. A second fear is that a hotter, drier climate will bring more forest fires, which will cause huge amounts of carbon dioxide to be expelled. Indeed, as temperatures have risen in much of the Canadian north in the past 30



years—northern Alberta is now three degrees F warmer than it was in the early 1970s—the acreage burned in Canadian forest fires has increased by half. Although fire is the prime regenerator of the boreal forest, scientists fear that a large increase in blazes caused by climate change and human incursion could upset the natural balance.

Alexander Lyubyakin believes he has seen a glimpse of such a future. Lyubyakin is head of the Aviation Firefighting Base in the Russian Far East, charged with protecting an area the size of Texas. In 1998 fires in his territory burned an area the size of Michigan, releasing carbon dioxide equivalent to roughly 4 percent of the carbon dioxide emitted worldwide by all man-made sources that year.

I visited the Khabarovsk region, the heart of Lyubyakin's territory, in mid-September. With Russia's economy and its wood products industry on the rebound after the 1990s—when timber harvesting dropped by 60 percent—there was abundant evidence of logging. Train cars stacked high with lumber rumbled down the Baikal-Amur Railway, much of it bound for China, where a growing economy and a near moratorium on logging have created high demand for Siberian wood. Khabarovsk's easily accessible forests have already been logged, forcing timber companies to forge ever deeper into the taiga. From the city of Komsomolsk on Amur I drove five hours to reach one of the closest logging areas. Along the way I passed numerous areas of burned forest—gray swaths of scorched tree trunks sprawling over the undulating landscape.

Lyubyakin has several interrelated concerns. The expanding network of logging roads is opening up the taiga to more people, leading to more fires. Wasteful Russian forestry practices leave as much as 40 percent of felled trees and limbs on the ground, providing fuel for blazes. Such sloppy logging, especially in wetter areas, interferes with the boreal forest's sponge-like qualities, increasing runoff and drying out woodlands. All this, and a drought, came together in 1998 to feed enormous fires, which Lyubyakin was unable to properly monitor or fight because budget cuts had drastically reduced the number of planes and firefighters.

"A catastrophic economic situation turned into a natural cataclysm," said Lyubyakin. "We have a huge territory with no forest at all because of logging and fires. And today we remain in the same extreme situation."

It is still unclear whether the Khabarovsk fires were caused by routine drought or are a harbinger of future forest destruction in a warmer world. One thing is certain however. The boreal forest is showing signs of climate-induced change. In central Alaska, where average summer temperatures are up about three degrees F in the past 80 years, vegetation is creeping northward and higher up mountainsides. On Alaska's Seward Peninsula bushy shrubs have begun growing where once there was only tundra. Permafrost, which underlies large swaths of the boreal forest, is warming and beginning to thaw in parts of Russia and Alaska. This could cause some wooded areas to disappear and become wetlands or grasslands.

Should such changes continue, some scientists fear that the intricate mosaic of boreal forests and wetlands could undergo significant transformations, such as bogs drying out and temperate species intruding from the south. An expansion of industrial activity into the north woods would probably exacerbate such changes. That is all the more reason, conservationists argue, to protect large areas of boreal forests, with their abundance of an increasingly scarce commodity: boundless wilderness.

Such efforts have so far met with mixed success. The huge Sakha

(Yakutiya) Republic in Siberia has recently protected 270,000 square miles of boreal forest—nearly half the area of Alaska—yet extensive logging continues in older boreal forests of European Russia. In Canada conservationists are trying to protect wild tracts, but the country has fallen far short of a federal recommendation to set aside 20 percent of the north woods from development.

"We're trying to reverse the process found in other world forests, which has been to allow economic development to carve up the forest and then try to save the scraps that are left," said Stewart Elgie of the Canadian Boreal Trust. "Most of the world's forests are islands of wilderness in a sea of development. We'd like to flip that around in the boreal and have islands of economic development in a sea of wilderness."

At times, from the air, the boreal forest does indeed seem boundless, inexhaustible, blessedly remote. It looked that way one afternoon last October as I flew over the Quebec lands of the James Bay Cree in a 1957 de Havilland Otter floatplane. With Giles Dionne, a veteran bush pilot, at the controls, we gently bumped along 1,500 feet above unmolested boreal forest, passing thousands of unnamed jigsaw-shaped lakes, their surfaces dotted with wooded islands. The deep green of the forest was often broken by a rust-colored swath of bog or the brass-colored cone of a larch, whose needles had passed the peak of fall brilliance and begun to drop.

We flew north for an hour, Dionne satisfying my desire to soar above the bush, far from civilization. With my face pressed to the glass, I fell into a tranquil state, soothed by the rocking of the Otter and the sight of nothing but trees and water stretching to infinity. Then we turned southeast, heading toward Lake Mistassini. I could see thick columns of white smoke rising from the far shore and spreading for miles to the northeast. Soon the source of the smoke was revealed: For miles around, logging companies were felling the forest, then torching mounds of branches and unused wood. It had snowed on the east side of the lake, and the logged quadrants stood out in stark, white relief against the darker stands of uncut conifers.

Banking sharply, we landed on a mile-long lake, cruising up to the shoreline cabin of Jimmy Gunner, one of several thousand Cree trappers. It was a picturesque spot, with tall spruce ringing the lake and an inch of snow surrounding Gunner's wooden house. While his wife prepared to skin a beaver, the 51-year-old trapper motored across the lake to his fishing nets, an errand that yielded a yard-long, copper-colored pike.

Like the native Khanty I had met in Siberia, Gunner felt as if the outside world was rapidly closing in on him. He had been trapping in this wilderness since he was four, but in recent years the timber companies had arrived, cutting about 25 percent of his trapline.

"They're logging 24 hours a day and have gotten to within three miles to the east of me and four miles to the west," said Gunner, a heavyset man with a dark goatee and black beret. "Sometimes, at night, you can see the lights from the machines."

We said good-bye to Gunner and took off. Our route led us over the smoldering slash piles, the smoke permeating the cabin with the sweet smell of a campfire. Snow spattered our windshield, occasionally obscuring the white rectangles of cleared forest that unrolled beneath the plane. We passed countless stacks of timber, prefab housing for the loggers, and trucks moving down dirt roads in the gathering dusk—all of it slowly making its way toward Jimmy Gunner and his patch of the north woods. □

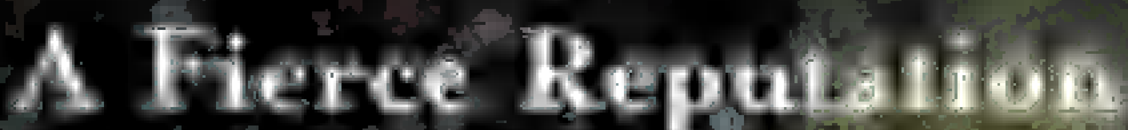
Birch and aspen rise from a carpet of horsetail and wild roses near Fairbanks, Alaska. "This area was burned or cut maybe 60 years ago," says ecologist Marilyn Walker of this view from her backyard. "Now a whole new plant community exists here. It's impossible to live in a place like this and not be fascinated by the forest's capacity to rebuild itself."

MORE ON OUR WEBSITE

Concerned about the future of the boreal forest? Share your thoughts on our forum board and find more images and field notes at **nationalgeographic.com/ngm/0206.**

Skillet-size paws have sharp, curved claws that enable a wolverine to scale a tall pine and survey its realm of forest along the Finland-Russia border. Occupying remote habitats and vast home territories, wolverines reign as the least known predators of the far north.

WOLVERINES
Beasts
OF THE
Boreal
BY TOM O'NEILL
NATIONAL GEOGRAPHIC
SENIOR WRITER
PHOTOGRAPHS BY
ANTTI LEINONEN



A Fierce Reputation

Tall tales and superstitions cling to the wolverine like a sorcerer's cloak, thickly furred. A wolverine will leap from a tree to kill a reindeer. It will shadow a trapper and break down his door to devour him. Sleeping under a wolverine skin condemns a person to endless hunger.

Naturalists who study wolverines and have seen their bared teeth and flashing claws understand the roots of these exaggerated tales. Yet this carnivore, which weighs up to 45 pounds and is the largest terrestrial member of the weasel family, would rather run up a tree or duck into a den than fight anything its size or larger. Rodents, fish, reptiles, and birds are favorite prey, but wolverines usually prefer carrion. *Gulo gulo*—the glutton—is a prime scavenger who buries for later use some of the meat it tears off. Having observed this wary creature in the forests surrounding Kuhmo, Finland, for 15 years, photographer Antti Leinonen provides rare glimpses of the true wolverine—a shy, secretive opportunist with a penchant for play.

Togetherness rules in summer when fast-growing kits learn [illegible] ways. Often [illegible] her young on hunts. [illegible] at left, [illegible] a limb with her [illegible] old male offspring while the female kit plays in lichen. "The mother favored the male," said [illegible]. "She fed him [illegible] him more [illegible]." The kits, which [illegible] about eight months with their [illegible], were abandoned early: Their [illegible] vanished, [illegible] by the [illegible] moose [illegible].

Hideouts and Lookouts

Wolverines depend on a vast home territory—as large as 200 square miles—that contains abundant shelter amid rocks and boulders. An adult male uses a cave as a resting stop (left) before resuming his hunting rounds. Wolverines also hole up to withstand severe storms and to elude bears, wolves, and hunters.

Outside the dens wolverines rely on their keen sense of smell to warn them of danger. Rising through a mosquito swarm (bottom), an adult sniffs the air to check for a possible intruder. Trees offer handy escape routes, as well as places to hide food and scout the surroundings (right). To get close to the hypersensitive wolverines, Leinonen works from a blind equipped with a pipe that carries off his scent.

Human settlement coupled with a low birthrate and small populations have shrunk wolverines' circumpolar distribution, which once spread as far south as the Black Sea (map, below). Their numbers largely unknown, wolverines are considered a rare, vulnerable species. The most stable populations exist in Alaska, western Canada, and Russia.

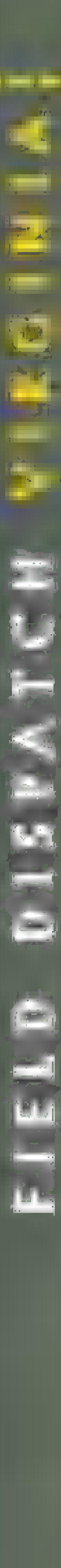
NG MAPS

The Lean Season

Built for the demanding northern winter, the nonhibernating wolverine scours its snowy range for small prey and, if it's lucky, a ready-made feast of carrion. Roadkill (above) supplied by the photographer fed a wolverine before a bear arrived to finish the meal. Powerful jaws allow wolverines to crunch the flesh of frozen prey. Flat paws (right) help them move quickly over hard snow to reach a carcass. In this region, leftovers from wolf kills provide most of the carrion. Wolverines here will chase down and kill wild reindeer, but they prefer domesticated ones, according to Leinonen. "Herded reindeer are semi-tame and are not adapted to run in deep snow," he said. "But the wild ones are usually too alert and fast—even for the wolverine." □

MORE ON OUR WEBSITE

Decorate your desktop with a wolverine image, and find field tales, more photographs, and tips from the photographer at **nationalgeographic.com/ngm/0206**.



NATIONAL GEOGRAPHIC RESEARCH AND EXPLORATION

GRANTEE
William Kelso
Archaeologist
Jamestown, Virginia

"James Fort is like the True Cross. This is the setting in which the play was carried out. This is the original evidence."

As darkness falls, excavators led by William Kelso, at right, hoist the remains of a young Jamestown settler killed by a gunshot wound.

Unsettling Discoveries at

Jamestown

Suffering and surviving in 17th-century Virginia

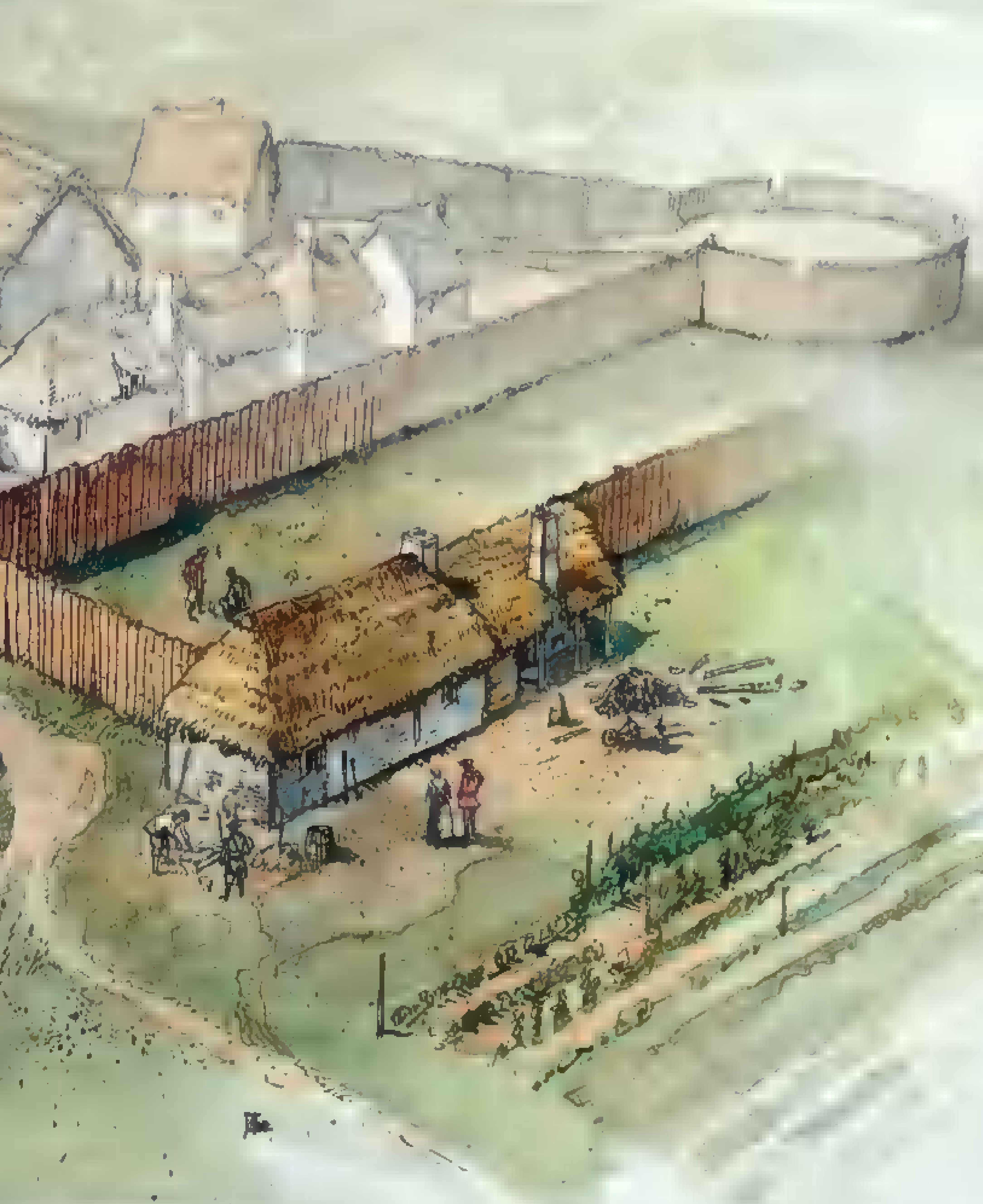
By Karen E. Lange
NATIONAL GEOGRAPHIC WRITER
Photographs by Ira Block

In April 1994 archaeologist William Kelso stood on a small island in the lower James River, a shovel in his hand and the future of his career at his feet. He had left a secure job at Thomas Jefferson's historic home of Monticello, taken ■ pay cut, and moved halfway across Virginia with his wife in order to prove ■ theory: that James Fort, the first successful English attempt to colonize the New World, could be found. For decades most archaeologists had assumed that the fort, which existed from 1607 into the 1620s, lay at the bottom of the James River, which had eroded hundreds of yards of shoreline since the early 17th century. Kelso was among a handful of scholars who disagreed, believing the fort's remains still rested on land, specifically on property owned by the Association for the Preservation of Virginia Antiquities (APVA). The APVA invited Kelso to attempt to uncover the fort, but at first could fund little but his salary. So he bought his own shovel and wheelbarrow and launched a one-man excavation, praying that he would soon discover something worthy of further financial support.

He set up ■ video camera to film his first shovels of dirt, then stepped back and began to dig, not far from where the APVA in 1922 had erected a monument to Pocahontas. Kelso remembers how strange he must have appeared: "A woman

"We . . . finished our Fort which was triangle wise, having three ■■■■■ at every corner like a halfe Moone," wrote colonist George Percy of the original fort from which Jamestown grew. Erected in 1607, the fort is drawn here ■■ it looked about 1608, after it had burned and been rebuilt and expanded. The long house and palisade on the outside may have been a trading post where the English exchanged copper and glass beads for Indian corn. Structures shown in a haze ■■■ suggested by historical records but have not yet been found. Across ■ field lies an unmarked burial place, perhaps for colonists struck down by disease.

[illegible] the foot of a monument [illegible] Pocahontas, Kelso's team uncovered two dark semicircles at [illegible] fort's southern bulwark (drawn below)—the narrower [illegible] from [illegible] [illegible] of [illegible] fort and the wider [illegible] [illegible] surrounding dry moat. A 1602 coin (opposite) found nearby helped date the site to Jamestown's first days.



came up and asked, 'What are you doing?' I said, 'I'm finding James Fort,' and she backed away with her son." Despite the doubtful stares of onlookers, Kelso kept digging and within hours reached a centuries-old trash pit. The soil was thick with glass beads, brass buttons, bits of pottery, and scraps of copper. "It was off the scale of any site I've worked on," Kelso says. "It was [illegible] clear as it gets in archaeology." Funding materialized, and within two years he and his team announced that they had found the holy grail of early American history—the palisades of James Fort, visible now as dark stains where wooden posts once stood.

"In this spot the first General Assembly met," Kelso says. "It was the first representative body, the origin of the American form of government."

Kelso's team had located [illegible] national shrine. They had also dug into one of the darkest periods of United States history,

[illegible] BY RICHARD SCHLECHT

Haphazardly dug graves in a James Fort cemetery may offer evidence of the "Starving Time" of 1609-1610, when more than two-thirds of the 215 colonists perished from hunger, disease, and Indian attacks. The odds of survival in early Jamestown were slim—80 percent of settlers sent between 1607 and 1625 died during that period. Sickness and shipwrecks took many others before they reached the New World. Excavated within the fort, a sea monster adorning a gentleman's silver tooth-and-ear pick (above) hints at the perils of the transatlantic crossing.

a time of starvation, epidemics, and war that saw both English and Indians slaughter unarmed men, women, and children. Of the 6,000 settlers the London-based Virginia Company sent to Jamestown between 1607 and 1625, 4,800 died. "When one stands at Jamestown today," writes archaeologist Ivor Noël Hume, "it is hard to imagine how much hope, regret, fear, hatred, hunger, pain, and dying

were experienced at this place."

Why did the establishment of British America come at so high a price? Working from historical accounts, scholars have long tried to answer this question. They've said that the colonists were poorly chosen—with far too many gentlemen, servants, and specialized artisans and far too few farmers. The colony was poorly led, its officers engaged more in power struggles than in making sure Jamestown had enough food, a healthy source of water, and well-maintained defenses. In the 1970s historian Edmund Morgan even argued that Jamestown's laborers, having come from an England beset by chronic underemployment, were accustomed to idleness—in a word, lazy.

Though archaeology can't ultimately explain what Morgan called the Jamestown Fiasco,

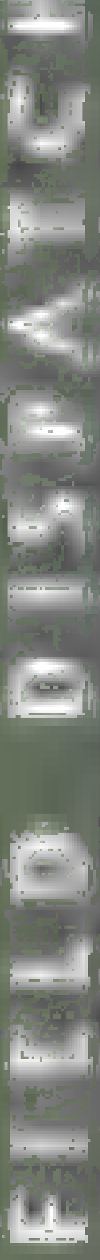
THE PROJECT

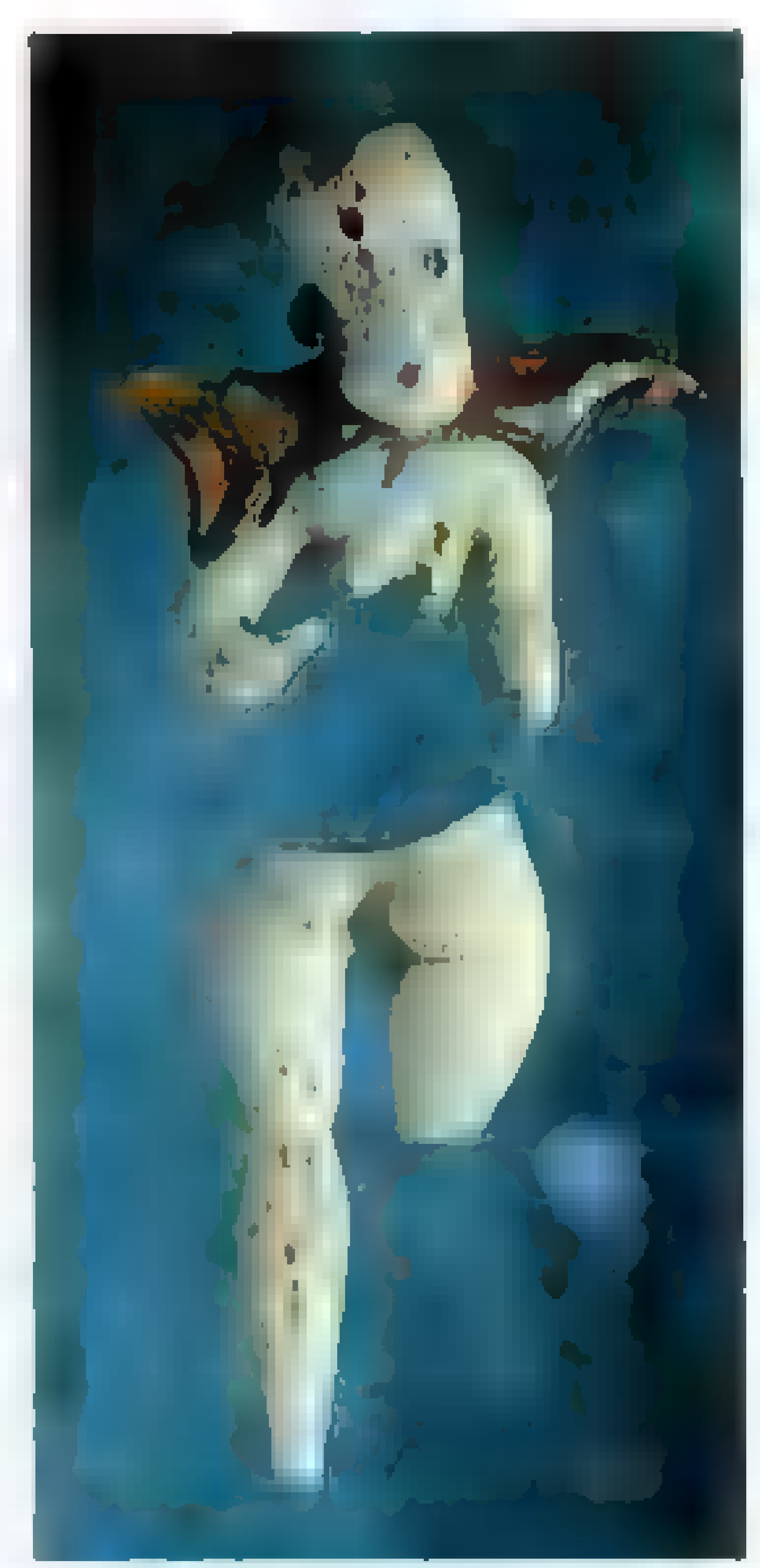
Jamestown, Va.

PREVIOUS EXCAVATIONS BY OTHERS AT JAMESTOWN: 1897, 1901, 1903, 1934-37, 1955

CONVENTIONAL WISDOM: THE FORT DISAPPEARED INTO THE RIVER IN THE 18TH CENTURY.

REASON FOR KELSO'S SUCCESS: "IT WAS PROBABLY MORE HOPE AND LUCK THAN ANYTHING ELSE. WE SAID, 'WE'RE GOING TO FIND THE FORT,' AND IT HAPPENED."





[illegible] of 17th-century tobacco pipes told archaeologists they had found James Fort. Sherds of English pottery [illegible] among the artifacts that helped them locate [illegible] structures. One-of-a-kind finds illustrate the lives of individuals: A settler may have [illegible] [illegible] one-inch-tall glass angel [illegible] guard against sterility. Part of an ivory compass (opposite) recalls the instrument [illegible] [illegible] amazed Captain John Smith's Indian captors that they spared his life.

it can put written accounts in context. Kelso's excavations have uncovered evidence that the colonists were working hard—at enterprises that met with only mixed success. Virginia Company investors wanted colonists to extract New World riches. Instead of spending time growing crops, settlers were instructed to search for gold and other commodities and turn Virginia's raw materials into profitable industries while bartering with Indians for food.

Kelso's team has found abundant signs of the colonists' labors: scores of fishhooks and tons of oyster shells; musket ball molds and Jamestown-cast lead bullets; fragments of earthenware stills for producing acids to refine metals; thick-sided pottery crucibles used to melt sand into glass; and, most numerous, scraps of copper—leftovers from pieces cut and shaped into ornaments prized by the Indians.

Copper was supposed to buy the colonists' food, but two things happened that the Virginia Company did not foresee. First, sailors on the ships that brought and supplied the settlers made clandestine black-market deals with the Indians that glutted the copper market and devalued the metal. Then drought took hold of Tidewater Virginia. Recent studies of tree rings have revealed that 1606-1612 was Jamestown's driest seven-year period in 770 years. Indian tribes that had eagerly provided corn stopped. No amount of copper would change their minds. The English response—raiding Indian villages to seize food—provoked attacks that left James Fort besieged.

In 1609-1610 the crisis reached a critical stage known as the "Starving Time." Kelso's team has unearthed remains of this desperate winter. Within the fort lay butchered bones of animals the settlers would only have eaten in extreme hunger—cats, dogs, horses, rats, and snakes, even poisonous ones. Outside the palisade to the north, in an unmarked, pre-1650 cemetery, lay evidence of hasty burials. Rather than facing east to west, as Christian tradition dictates, the graves were dug every which way. Instead of being wrapped in shrouds, corpses were left in their clothes. And bodies were tossed into the burial shafts, some two to a grave, two face down. "They were just trying to get people in the ground," says Ashley McKeown, a forensic anthropologist on Kelso's team.

Most settlers died of "meere famine," wrote chronicler George Percy. Others suffered "swellings" and "burning fevers." To learn what caused such symptoms, McKeown this year will use a grant from National Geographic to study several sets of settlers' remains. Bubonic plague, malaria, and tuberculosis leave signatures in mitochondrial DNA. Such diseases, along with malnutrition and polluted drinking water, could explain why so many colonists

died, sickened, or reportedly went insane.

Utterly spent and without food, the remaining colonists in 1610 boarded ships to abandon Jamestown. As they began to sail away, a supply ship arrived. The settlers returned to Jamestown, and the colony endured to become Virginia's first capital. In this Kelso finds inspiration. "They ate snakes and rats, but they survived," he says.

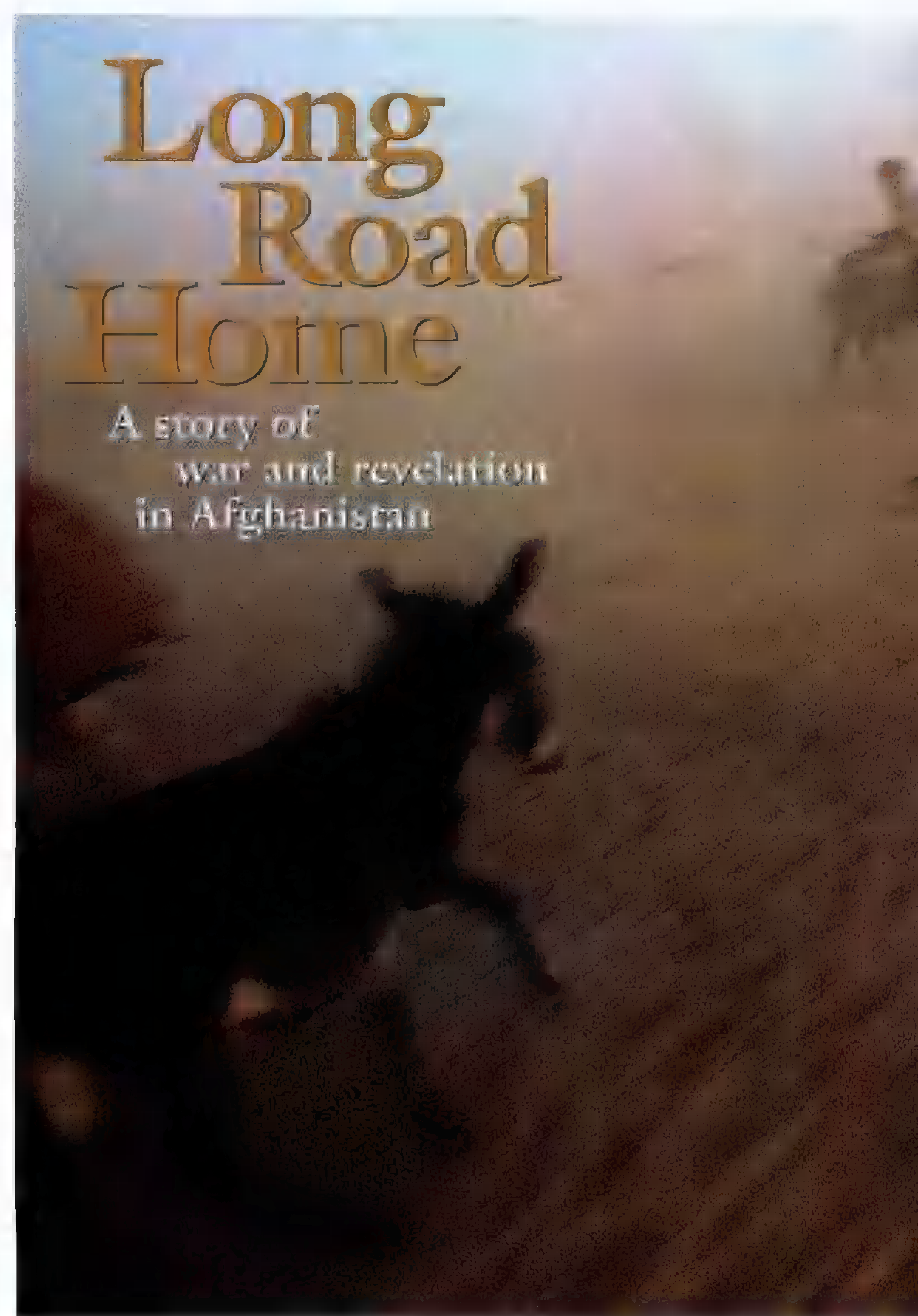
A former amateur football player and coach, Kelso effuses enthusiasm. Jamestown is his underdog team, his against-the-odds winner. "It was an experiment, it was trial and error," he says. "And finally they got it figured out: The land was the gold."

To recruit more colonists, raise capital, and control the sale of the new cash crop, tobacco, the Virginia Company started issuing parcels of land to settlers and to others who bought shares. As a further incentive to colonists, the company created the Virginia General Assembly in 1619. "They could own land and vote," Kelso says. "Here's private enterprise and freedom"—the seeds that would grow into the United States. For the Indians it would mean near extinction. For Africans shipped to tobacco plantations it would mean slavery. But for colonists willing to risk death on a frontier, it would mean unheard of opportunity. □

Twenty-first-century Americans encounter the skeleton of a forebear. Unearthed in James Fort, the young upper-class man bled to death in the 1600s after someone shot him in the lower right leg. A hunting accident? A murder? His death remains a mystery, but archaeology is revealing why so many others perished—and how the colony they founded ultimately survived.

MORE ON OUR WEBSITE

Want to learn more about Jamestown? Post a question for archaeologist William Kelso and watch for his weekly replies at nationalgeographic.com/ngm/0206.



Long Road Home

A story of war and revelation in Afghanistan

SHEPHERD BOYS GUIDE THEIR FLOCK THROUGH A REFUGEE CAMP IN KHODJA BAHAUDDIN, AFGHANISTAN.

CROWDS OF HUNGRY REFUGEES CONVERGE ON AN EMERGENCY FOOD DISTRIBUTION CENTER IN DASHT-E QALEH.

Late at night I sit in my apartment in Washington, D.C., watching U.S. leaders talk on television about the war on terrorism. Afghanistan moves in and out of these conversations,

as it does with the headlines. One day there's a lethal flare-up in a mountain stronghold. Later the situation is "controlled," and newsroom pundits move on to other hot spots like Iran, Kashmir, or Somalia. Then my phone rings. The call is from Afghanistan.

It's my former translator, Ahmad Zia Masud, now a negotiator for Afghanistan's hastily formed Ministry of Defense. He calls me often by satellite phone from mountaintops, villages, and caves where he is meeting with resisters to reform—Taliban fighters, independent warlords—who, after decades of war, are reluctant or unwilling to lay down their guns. Sometimes Masud and other negotiators are threatened and forced to retreat. Soldiers then move in, and the hills resound once more with war.

"This is a very dangerous time for my country," Masud tells me. "Every day I see disaster. The young boys, they know only war, nothing else. What will happen to them? I believe food will come, factories will come, but now the people are suffering. Even if peace comes, so much has died."

From last October into December, Masud and I worked together day and night in the parched hills and plains of northern Afghanistan, where I was on assignment as a photojournalist for *The Washington Post*. Masud was in his eighth year of forced exile from his home in Taliban-controlled Kabul, working mostly for Northern Alliance leadership. When hundreds of foreign journalists began descending into Khodja Bahauddin, site of the Northern Alliance's government headquarters, the foreign ministry assembled an army of translators. Masud, with halting English but well connected, wound up with me. He is a devout Muslim and father of three; I an unveiled, single Western woman. Neither of us imagined how our minds and lives would mingle—and be forever changed.

From the start we covered frontline stories, which required a steady diet of Russian military maps, bareback rides on mountain-bred horses across frigid rivers, a phone book filled with satellite numbers for field commanders, and a stomach for black tea. Some days mortar fire thundered constantly. Other days were still. The United States had announced that it would launch air strikes on Taliban positions, but the Northern Alliance frontline commanders we were meeting with weren't being told when. So they held their men in check, awaiting the U.S. campaign that would allow them to take the offensive against weakened Taliban territory. This lull created space to report beyond the front lines, to provide social and historical background for the conflict. Camera in hand, I set out to document the "collateral"

By foot and by rumbling Russian tank, Northern Alliance soldiers made their way over ragged hills toward Kunduz during last fall's Ramadan offensive, a bid to overtake Taliban-controlled territory.

consequences of the war. From dawn to dark Masud and I bounced around in a Russian jeep to find Afghan people and their stories. Along the way, sharing hundreds of miles, our own stories unfolded.

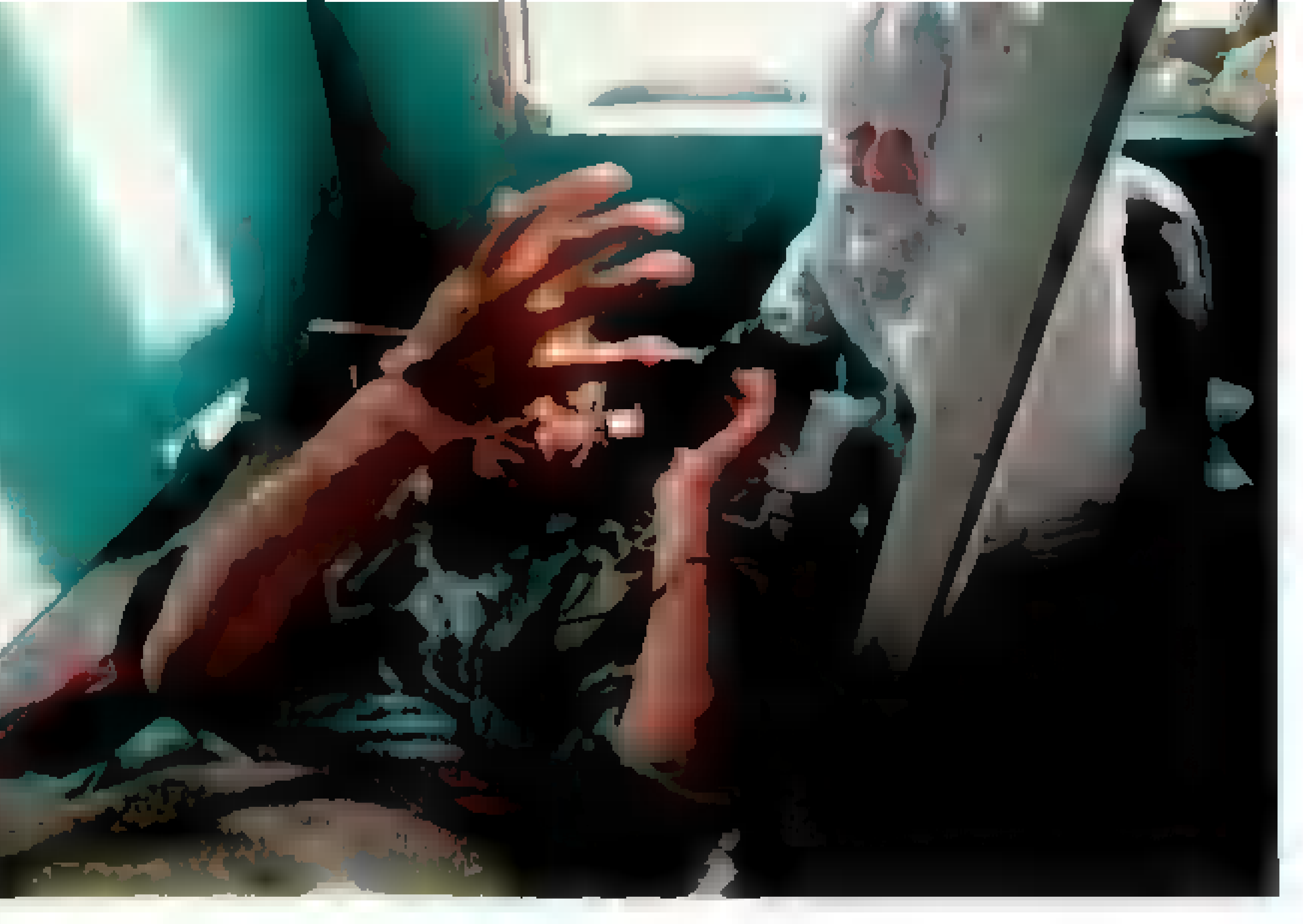
Educated at Kabul University, Masud was still a consummate student at age 32. He carried a small, lined notebook in his chest pocket, which he filled each working day with new English words. (Once when we were under fire he yelled, "Make yourself small!" "You mean scrunch down?" I shouted back. "Scrunch" made its way into his book.) He has immense curiosity. Yet Masud had chosen to avoid all contact with Western cultures abroad and instead became a religious-political activist, nurturing strict devotion to Islam among his people. My own curiosity had led me to spend more than a decade living in remote corners of China, India, and Tibet—none so ravaged as Afghanistan.

Day after day Masud interpreted his war-torn world for me. I photographed young students, hungry for knowledge, whose schools had been commandeered by Taliban troops and turned into garbage-strewn military barracks. We met families, three generations deep, displaced to bare-bones refugee camps. We found fragmented lives—scattered to hospitals, cemeteries, and prisons.

The prison at Khodja Bahauddin was made of clay. Small, dank cells had one tiny hole cut high on the wall. While I was waiting to interview some Taliban inmates, guards and low-risk prisoners circled me, muttering ominously. I looked to Masud, my vigilant protector. He spoke sharply, and everyone backed off. The prison director opened a cell, offering me "any" Talib. I peered in and discerned, barely, six hunched figures. We entered the cell. As I began to sit, Masud warned me of "small friends," our code words for lice, fleas, and other creatures that had invaded our sleeping bags in a bunker near the front lines. I squatted to talk with the prisoners, who ranged in age from 17 to 43. Every one of them claimed they had been drafted, under threat of death, to fight for the Taliban. They talked of their crops and families, wives and children left behind. Later the prison director said, "Maybe they are farmers. But they killed our soldiers. They should die." Shortly afterward one prisoner did die, of illness, right before our eyes. "Have you seen many people die?" I asked Masud. He exploded in anger: "This is new for you. War, death, and dying is our way of life."

"Are you a Muslim or a heathen?" a 14-year-old boy shouted at me. I thought hard before answering. How should the "heathen" reply to keep the young Islamic student engaged in conversation?

A RECENTLY LIBERATED SCHOOL, ONCE USED AS A TALIBAN BARRACKS, BRINGS HOPE TO SCHOOLBOYS IN TALOQAN.

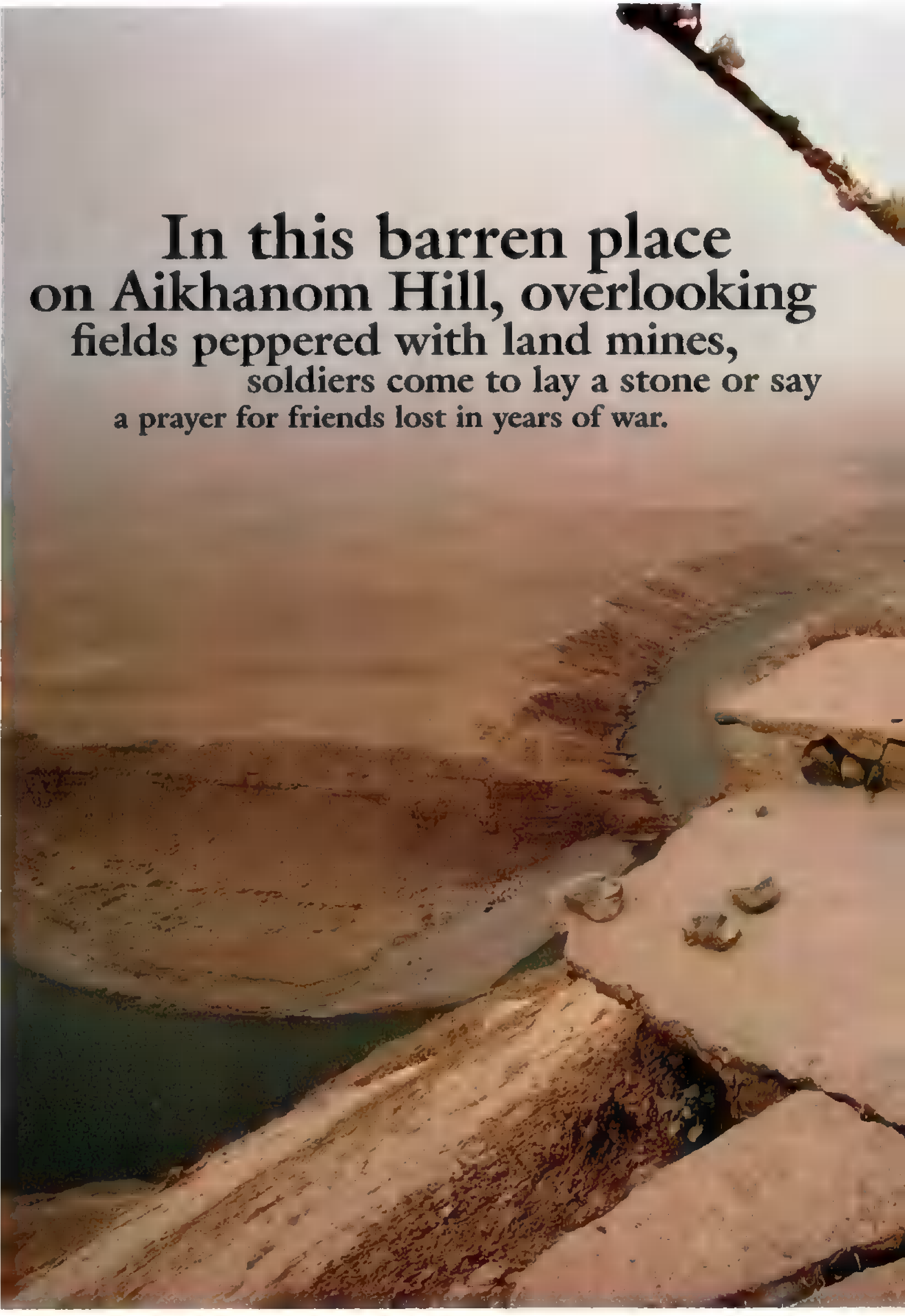


Engineer Ibrahim Shakir, his mother at his side, convulses in the delirium of gangrene after being riddled with the bullets of a retreating Taliban fighter. Shakir was rushed to Taloqan Public Hospital but found no medicine, electricity, or blood bank. Taliban troops had emptied the hospital of all supplies. Bibi Lala (right, seated) and her two young children fled Taloqan when the Taliban burned their home to the ground. For more than a year the displaced family has been living with 3,000 others in the Dasht-e Qaleh refugee camp.

Such suffering failed to dim Masud's sense of hope. That hope was rooted in a deep devotion to God, which I learned through his long, joyful renditions of Koranic stories. Our trips by jeep or horseback were punctuated each day by sunset prayer, even when shells were flying. Despite the constant threat of danger and death, Masud and other Afghans I met strove for normalcy in their lives. Imposing the rhythms of religion, they transformed one more day of war into one more night of peace. We'd break Ramadan fast at sunset with still-warm bread made with prayerful hands in an outdoor clay oven—soldiers, civilians, and one foreigner seated on the ground, a complex human circle bound by simple bread. The teachings of Islam seemed to temper potential violence in a poor and desperate people. Yet taken to fundamentalist extremes, that same faith was also motivating Taliban fighters just over the next hill, who wanted to kill, certainly me, but also their Muslim brothers. Masud was more of a brother than most. He, like most Taliban, is ethnically Pashtun, one of the few working with the Northern Alliance.

Once, when we were deep in the desert, Masud announced that if he were governor of an Afghan state, he would rule by Koranic law, ordering immediate execution for adulterous men and women. (This he offered as proof that Islam held women in high esteem.) Muslims who converted to Christianity would also die. I had seen this man comfort despairing widows, disarm deranged soldiers, play with childlike abandon, and respond with patience to foreigners who knew nothing of his culture. Such compassion, playfulness, and respect seemed at odds with his fundamentalist fervor. I wondered where he housed such rigid rules—and didn't yet realize that my landing in his world was causing those walls to tremble.

One day we visited Lalaguzar, a sprawling refugee camp near Khodja. Weeks earlier I had watched a boy there toss a tiny ball made of plastic wrapped with twine. The sand-colored ball was constantly disappearing or unwinding. Later, in a far-off town, I bought a soccer ball. Masud and I returned to Lalaguzar and wandered through miles of indistinguishable tents, looking for the boy. Giggling children, all hungry for play, crowded around. As I offered a kicking lesson, some women peeked at us from behind a tent. Masud kicked the ball,



In this barren place on Aikhanom Hill, overlooking fields peppered with land mines, soldiers come to lay a stone or say a prayer for friends lost in years of war.

STONES AND STRIPS OF TATTERED CLOTHING FORM A SACRED MEMORIAL FOR FALLEN COMRADES NEAR KHVAJEH GHAR.

Adorned with the artwork of war, a house in Taloqan serves as a stage for historic transformation the day after the city's liberation from Taliban occupiers. Northern Alliance spies (left), who had worked undercover in the ranks of the enemy, symbolically joined their brothers by tearing off their distinctly Taliban turbans. Translator Ahmad Zia Masud (above, standing), helped to defuse distrust between his fellow soldiers and local men. The Northern Alliance had gained vital ground, but after years of surviving only by the sword, many wondered whether they would ever be able to lay down their arms.

and one of the women kicked it back. "Oh, no," said Masud, only half-joking. "Maybe her husband will kill me. I played soccer with his wife."

That afternoon we returned to Khodja and sat with tea on the concrete stoop outside my room. Masud poured the tea, then abruptly confessed that he felt conflicted in my presence. "It is a sin to be with you, talking friendly in this way," he said. "I must pray very hard every night after leaving you."

I wasn't ready for this. We had been working together, almost every day, for weeks. "You are saying I am a sin?"

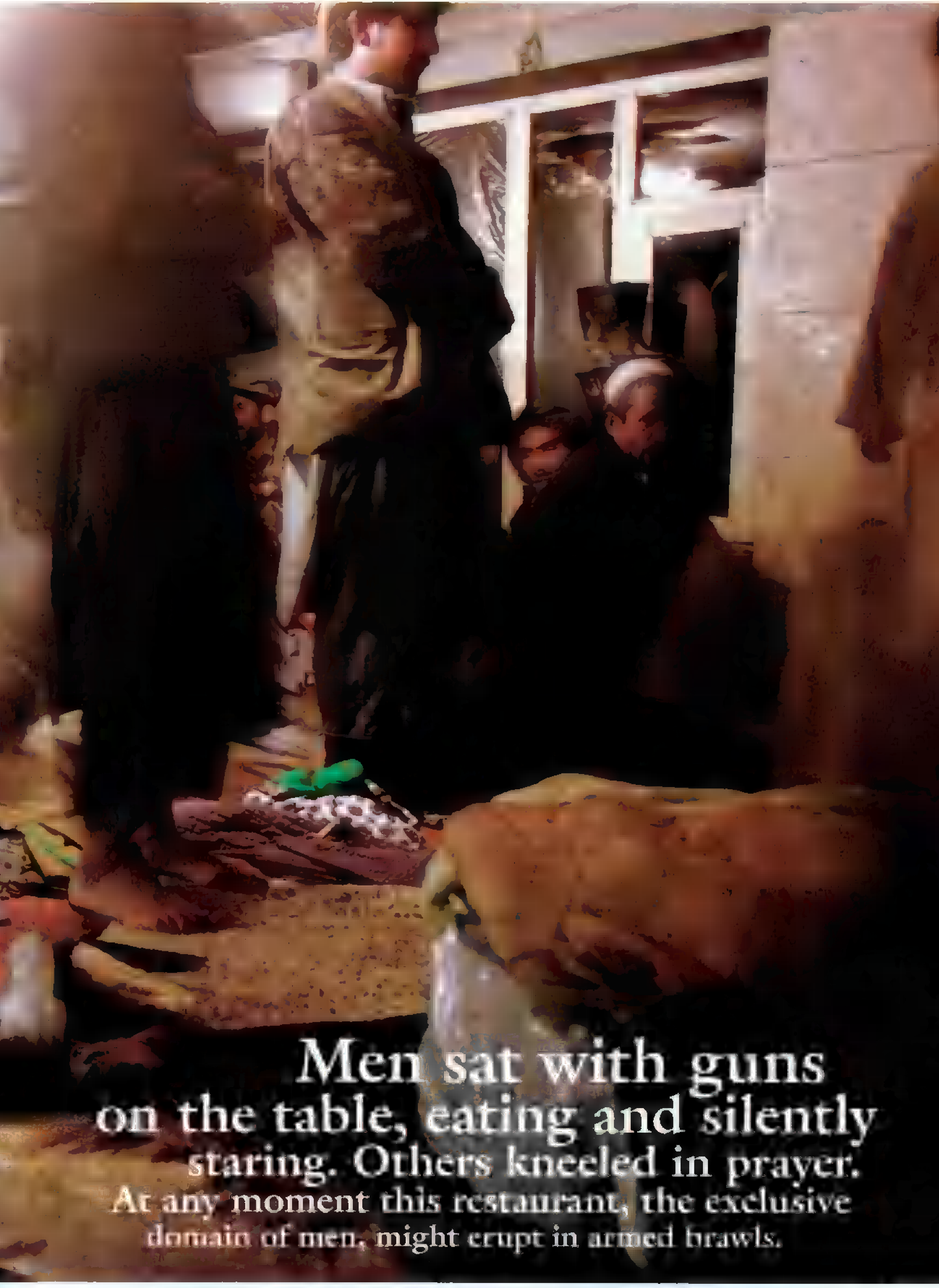
"Yes. A man must not speak friendly with a woman who is not his wife. I love my wife very much. We have rules. You are not Muslim. But this is not the main thing. It is dangerous. You should be covered." I instinctively tightened my scarf around my head. "The people of Afghanistan do not want you here."

"I see." I stayed calm but was inwardly stunned because, until then, I had thought we understood each other and communicated in ways that were, at times, extraordinary. Now I was a sin.

He went on. "Nobody wants foreigners here. I hate America. In too many ways, I hate America."

His words sank into silence. We had already discussed what we both viewed as the rampant materialism of U.S. culture. Masud believed that American peacetime society, rife with crime, was the inevitable consequence of spiritual bankruptcy. He feared that Americans in Afghanistan—soldiers, journalists, businessmen, even peacekeepers—would carry with them these same cultural values. I could see, and agree with, some of what he said. Now my Afghan translator, who was becoming my friend, seemed to equate me with an enemy. I was a sin from a nation he loathed.

Tears welling up, I surrendered. "Okay, I understand." Then I looked up and saw tears coursing down his face. "Masud, why are you crying?" "I cry because I have hurt you," he said. "Speaking with you is a small sin; this is a big sin. The heart is a holy place, and we must always take care to never hurt one another. I am sorry. Now I must leave." He rose to his feet, planning to resign as my translator. We were both off balance, but I wanted him to stay. "Wait. Please. You will be part of Afghanistan's new



AT A TALOQAN RESTAURANT SOLDIERS [illegible] FOR SUNDOWN PRAYERS BEFORE HEADING BACK TO THE FRONT LINE.

An intense game of chess in an underground bunker allows the practice of patience—and the relief of escape—during the downtime of war. Northern Alliance soldiers, outnumbered and outgunned by the Taliban, waged a mostly defensive war from the hills of northern Afghanistan, controlling less than 10 percent of the country. Most fighting took place at night under cover of darkness. Soldiers on Kapahasan Hill (right) watch the glow of U.S. bombs exploding on their enemy's positions at Taloqan. The mood was mixed: Battle-weary soldiers sensed the war's end, but foreigners were killing their countrymen.

government. Contact with the West is now inevitable. You will have to deal with foreigners, if for no other reason than to protect what you feel is precious about Islam and Afghan culture. You can be both bridge and gatekeeper for your people."

The optimist and the fundamentalist were tangled in a web. In the end Masud chose to stay. He was beginning to trust me, and that troubled him. Because I was not Muslim, he had assumed I would never understand his world. Yet my work had taken us together into the raw lives of strangers, giving us common ground where we could challenge each other's thinking. He entered new words in his notebook that night—"flexibility" and "cultural relativity," ideas we discussed at length. We then retired to our separate quarters for exhausted sleep.

When the war heated up, Masud made it his business each day to get us to the front line for battle and back to safe haven by night. He had friends in both places who helped when they could. One position we returned to often was the post at Kapahasan Hill, a series of underground bunkers built into hills facing Taliban strongholds in nearby Taloqan. Masud and I always went first to Commander Zuhoor's bunker. Welcomed by him and protected by Masud, I felt safe. This evening in a small underground chamber Abdul Rozaq, chief radio operator, worked the ancient wireless—a crackling lifeline powered by a car battery—checking on men posted along the mountainous 28-mile Northern Alliance front.

Commander Zuhoor, age 30, a strong, soft-spoken man who read himself to sleep each night, was issuing orders to his men. As his charges—very young and awfully old—departed for the dark unknown, he urged each one to be careful. The U.S. bombing campaign had finally begun. Taloqan was next, and the Taliban were desperate. Someone would certainly die before this night was over.

The young commander, who started soldiering at 15, turned to us and asked if we wanted sugar in our tea. He apologized for not having any food, and then said he must leave. But if we needed anything at all, Rozaq could find him by

radio. Next, a soldier strapped the commander with supplies so he could lead an advance minesweeping team down into the valley, into the heart of Taliban territory. Rozaq, who never left his post, spoke as his leader headed out. "That man, my brother, my father, he is worth a thousand ordinary soldiers."

We all fell silent, feeling the long reach of the gentle commander, imagining his footsteps moving in darkness, knowing that battle was near. Masud and I went out for air. The mountains were magnified in moonlight and unearthly still. There is no electricity, no air pollution, to disrupt the night sky. It is alive with stars, brilliant bits of dust floating in a giant cup of jet-black tea. You breathe deep on top of Afghan mountains and inhale the universe.

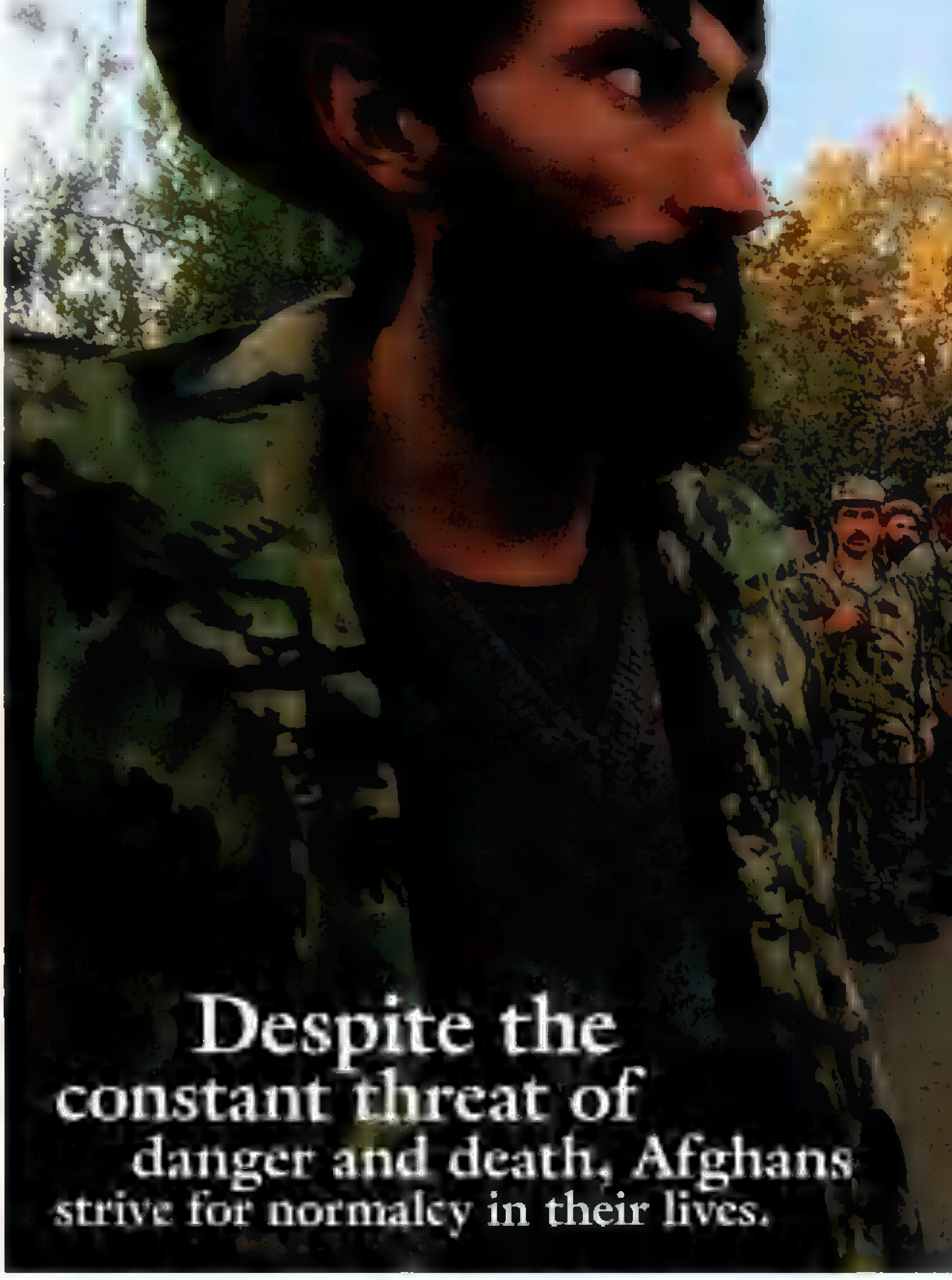
Later that night the silence was shattered by the relentless, suffocating thud of Taliban rockets. Inside the bunker I asked Masud to explain how both the Northern Alliance and Taliban soldiers could use the broad Islamic concept of jihad, or "struggle," to sanction killing fellow Muslims. "It is complicated," he said, suddenly smiling. "You like, I use my new word 'complicated'?" He paused. "We believe there is only one God, Allah, and our life on Earth is to serve him only. Unfortunately, the human is weak, and unwise mullahs, with wrong thinking, disobey the law of the Koran and lead the people in a dangerous direction. This war is about power, not God."

"But how does a good and gracious God, as you describe yours, justify killing in his name?"

"Oh, Lois, I am a weak teacher for you," he said. "Our God does not want the people to be killing. Long ago the Muslim world was under attack by Christians who wanted to make all of Islam disappear from Earth. Jihad was about survival. For us jihad with weapons is a last resort. It is a very desperate thing. The greatest jihad, our God teaches us, is jihad of the heart."

The next morning I was blasted awake before dawn by thunderous explosions. U.S. B-52s had found their mark at Taloqan. Oddly, I felt secure lying against the bunker's earthen wall. I found I had become so deeply immersed in the assignment that my attitude matched the Muslim belief that you cannot save yourself from death—when your time comes, you will go. This calmed me as I worked.

A young girl, sent by her mother just after sunrise to buy the family's daily bread at a Taloqan market, returns along a route transformed. Uniformed soldiers of the Northern Alliance, who had captured Taloqan the night before, filled the streets for days, celebrating their victory.



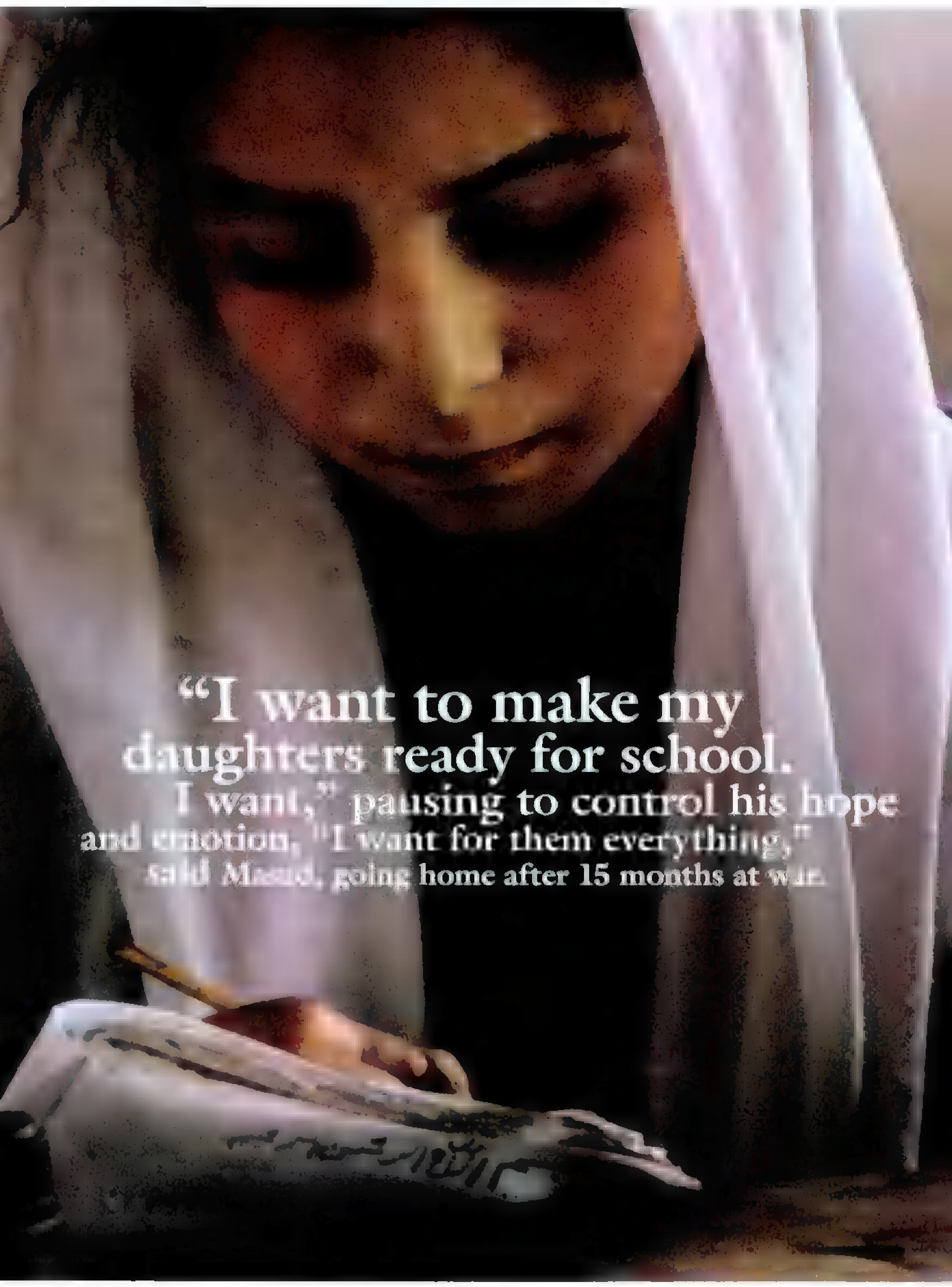
I thought of the Northern Alliance soldiers, who, outnumbered and outgunned, had been fighting a war far from home for more than six years. With every bomb that fell from the sky, each man was closer to going home. But home to what? Loved ones dead. Towns and cities destroyed. Farmlands riddled with land mines. I would soon return to the U.S., whose planes were flying overhead. Masud would spend the rest of his life cleaning up the mess from this war and others before it.

Still in my sleeping bag, I turned toward the bunker's blanketed doorway. In the dim light of dawn I saw a silhouette. With eyes closed, palms up, lips moving in silent prayer, and cheeks wet with tears, Masud was talking with his God. I closed my eyes, allowing him privacy, and turned back to the wall, knowing I could offer nothing that would help him. My own tears fell silently, separate from his, but into the same earth. I was learning, in this paradoxical world of rigid rules and barely controlled chaos, that there is a certain beauty in boundaries. The discovery did not come without pain.

This bunker had been a place of great intimacy, where hardened warriors huddled around dim kerosene lanterns late at night, listening to their commander read aloud from tattered pages of Persian poetry, delicate stories about brave young men riding off on horseback to fight the good war, leaving behind trails of flower petals that their unrequited loves could never follow. Now they were on the move, a restless river of men flowing along a dusty dirt road leading to Taloqan.

Five thousand advancing Northern Alliance troops halted at sundown in a narrow valley stretched between foothills of the Hindu Kush. Their general, Dawood Khan, with advisers and bodyguards, climbed an adjoining hill overlooking the city. They laid their scarves on the rocky ground and, kneeling close together, prepared to pray.

The surrounding hills abruptly exploded in fire. Mortars, tanks, rockets, and machine guns hammered the soldiers, who scattered for cover. The commanders continued to pray. I moved in what seemed like slow motion,


"I want to make my
daughters ready for school.
I want," pausing to control his hope
and emotion, "I want for them everything,"
said Masud, going home after 15 months at war.

GIRLS' SCHOOL IN CHAH-E BECAME A HAVEN FOR MANY REFUGEES.

"Let me try again!" said Masud, challenged by a children's game at the Lalaguzar refugee camp near Khodja Bahauddin. "He was as comfortable with a frontline general as with an orphaned child," says Raimondo. "Masud's method of work and play assured us hospitality wherever we went. Together we could engage with the Afghan people from morning to night. When it came time for me to leave, it was snowing, much needed moisture that hinted at promise for future harvests. Yet as I drove away in a battered jeep (right), everything I saw through the muddy windshield spoke of both promise and loss."

making pictures. The bloody bodies of land mine victims were being rushed back through the ranks. Soldiers began to run in panicked retreat. Suddenly a voice stopped me in my tracks. "Allah akbar! (God is great!) Forward! Allah akbar!" Looking over my shoulder I saw Masud standing firm in the midst of a massive retreat. Blocked by the passion of his war cry, the fighters slowed, stopped, then returned to battle. Masud's voice rang through the valley.

In that moment he was a stranger to me. But in his voice I heard his history: The young boy of seven who watched wide-eyed as Russian tanks rolled into Kabul; the idealistic student who saw two of his closest friends die at his side defending their city from the Taliban; the dedicated husband and father willing to die that day to make a better future for his people.

When the sun came up the next morning, Masud and I walked the streets of newly liberated Taloqan. Friends whom he had not seen for years rushed at him from the celebratory crowd. They toppled over, laughing and hugging. I watched his joy expand with every acquaintance found alive. Meanwhile his wireless radio crackled with a call for work to be done. It fell to Masud to set up the new headquarters in Taloqan and to negotiate with remaining Taliban. He spoke on the radio while looking out for me, trying to keep men from crowding too close. I shouted that I was okay, that he should move ahead. We both knew that with the liberation of Taloqan, our separation was imminent.

Masud called to me: "I do not want to leave you." Then suddenly I found before me a young schoolteacher, Nasir Sabawoon, who spoke nearly perfect English. Masud interrogated the teacher, then I hired him as my new translator. A few hours later I moved into Nasir's mother's house, into the "ladies quarters," one room that housed his mother, six sisters, several nieces, three granddaughters, and now me. Fresh bread was baking in the family's clay oven. A tree with giant lemons grew in the courtyard. Children chased each other in circles while two beautiful women, diaphanous scarves draped around their heads, laughed and swept a Persian carpet, gesturing for me to join them. I had come out from the desert and landed in a fairy tale—which always must end.

A month later, the time had come for me to leave. It was snowing. Masud

had come to say good-bye. "How do I say good-bye to you?" I said. He struggled to reply. "You have been my closest friend. You have taught me 'flexible' and 'complicated.' I am a different man because of you." He paused. "I can no longer hate America, because you are there." He gave me gifts for my nephews, three small vests of leather and fur. Then he put his hand over his heart, and we parted.

Masud worked his way south over snowy mountains to Kabul, where he was reunited with his family, briefly, before being called upon to help secure remote hostile regions of the country. When he phones me now, he tells me of the "total devastation of buildings, land, and people's minds." He worries that aid from the U.S. and other foreign powers will degrade his culture. He cringes when new Afghan leaders who have lived most of their lives abroad talk of a "new Afghanistan" and "globalization." I've never heard him sound so tired, or so sad.

"These people do not know my country. What must we call this? 'Cultural relativity?' Remember our time with that word?" he laughs quietly. "We are a very religious people. Our ideas are very different. I am afraid for Afghanistan. These are the things you must write about. Otherwise, your words will have no soul." I ask if I can also tell our story. "If it can help the world know there is beauty and peace in Islam, then you must tell it," he said.

Before I left for Afghanistan, an American friend gave me a gift, six simple words of encouragement. As Masud and I moved with the war across northern Afghanistan, we shared these same six words between us. When I was face-to-face with the wrathful fury of an American-hating Talib, Masud spoke them softly to steady me. When he went undercover deep in the mountains trying to turn Pashtun Taliban into Northern Alliance soldiers, I did the same for him. I, now comfortable in the United States, he, wrestling with an increasingly splintered "coalition" in Afghanistan, end our long-distance phone conversation with six simple words: "Be smart. Be brave. Be afraid." ▯

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Join Lois Raimondo for a video interview from the front line at nationalgeographic.com/ngm/0206.

EMPIRES ACROSS THE ANDES

BY A.D. 600—EIGHT CENTURIES BEFORE THE RISE OF THE INCA EMPIRE—TWO KINGDOMS DOMINATED THE ANDEAN WORLD. TO THE NORTH WERE THE WARI, SKILLED ROAD BUILDERS AND POTTERS. TO THE SOUTH LIVED THE TIWANAKU, THE GREAT TEMPLE MASONS OF LAKE TITICACA.

New finds, like this Wari fox whistle, reveal secrets of the first imperialist cultures of the Americas.

Sparks rain down like blessings during Copacabana's celebration of the Virgin of Candelaria, a wooden carving said to have healing powers. A Bolivian town on Lake Titicaca, Copacabana has drawn pilgrims since Tiwanaku times. Both the Wari and Tiwanaku used the power of religion to control their realms.

BY VIRGINIA MORELL

PHOTOGRAPHS BY

KENNETH GARRETT

Shamans sell prayers to visitors near the Island of the Sun, a former Tiwanaku shrine in Lake Titicaca that became the legendary birthplace of the Inca. The Inca claimed the earlier culture as their spiritual ancestor.

The looters had broken into the royal tomb in the ancient Andean capital of Wari, Peru, with picks and shovels, then dropped a rope into the stone-lined shaft. They had made off with whatever treasure the Wari people had left behind to honor their dead. Now, flashlight in hand, I squeeze into the tomb's ragged entry hole to get a close look at the artful stonework of these forgotten Andean empire builders.

Long before the Inca established their Andes-spanning empire, the Wari (Huari) created one nearly as large—and far more enduring. While the Inca state lasted barely a hundred years, the Wari carried on for well over four hundred, from about A.D. 600 to 1000, as did a neighboring kingdom in Bolivia, Tiwanaku (Tiahuanaco). Together

The former freight train of the Andes, a llama caravan heads toward Lake Titicaca. Thousands of llamas once grazed the lake's high basin, providing food, wealth, and a vital lifeline between early Andean cities.

these two civilizations set the stage for later empires in the Andes.

I follow William Isbell, an archaeologist at the State University of New York in Binghamton, down a crude rope ladder into the darkness of the four-by-four-foot shaft. Since its makeshift loops are set far apart, I slide more than climb down it. Fifteen feet from the top the shaft ends in a rubble-covered floor. I switch on my flashlight and peer at the rock wall around me. Every stone is smoothed of rough surfaces and perfectly fitted to its neighbor. Below me Isbell calls out directions.

"You'll see a small opening behind you. Crawl down that. Just watch your head."

Poking my light into the dark hole, I creep down the tumbled rocks into another smaller chamber five feet beneath the first landing. Huge rock slabs form the ceiling here, and the floor is buried under dusty piles of loose rock. It is impossible to stand up straight, so like Isbell I stay in a crouched position.

"The Wari dug this tomb in the shape of a llama, then lined it with stones," he explains. "You and I are in the llama's head," he adds, shining his light over the edges of the rock walls. "If you look behind me, you'll see another room that forms its ears."

Leaning around Isbell, I look into the chamber whose long, narrow walls are set back from this one, trying to visualize the llama-shaped tomb.

"And ahead of us," he says, shining his light in the opposite direction, "are the stomach and legs."

A big man with silver hair and beard, Isbell

grunts as he crawls into the belly of the llama. Four shorter rooms—the legs—branch off from this long one, and we peer into each. Then, after clambering over more rubble and the odd human and animal bone, we finally reach the smallest room of all, the llama's tail.

"We think this is where the king was buried," Isbell says, leaning over the edge of a narrow circular shaft dug into the floor. Although earlier archaeologists did not discover objects smacking of royalty in any of the rooms, Isbell believes that the unique structure of the subterranean llama-shaped chamber means it must have been constructed for the highest ranking member of the Wari elite. At the very bottom of the tomb, 12 feet below us, lies an empty stone-lined cavity. Perhaps when it was built more than a thousand years ago, it held a royal leader's mummy, ceramic vessels laden with food, the bones of sacrificed llamas, and exquisite objects of silver, turquoise, and gold.

"You can imagine all kinds of things," Isbell says. "The one thing structures like this clearly demonstrate is that the Wari were master architects and engineers."

They were also empire builders—perhaps the first imperial-minded people in the Americas. At its height the Wari Empire encompassed much of the high Andes, extending north nearly a thousand miles from the southern border of what is now Peru. Like other imperialists the Wari controlled distant colonies, including some along Peru's southern coast. And like many other empires it had a rival: Tiwanaku, near the shores of Lake Titicaca in Bolivia. Both had a ruling elite that oversaw the

FIRST AMERICAN EMPIRES

Ancient road
Modern road
Ruin
Scale varies in this perspective.

Viracochapampa
Marañón
Ucayali
Pucallpa
Huánuco
North
Lima
Pachacamac
Azángaro
Ayacucho
Apurímac
Urubamba
Conchopata
Machu Picchu
Jincamocco
Cusco
Pikillacta
PERU
ANDES
Colca
Camaná
Pucará
Arequipa
Puno
Tambo
Cerro Baúl
Osmore
Moquegua
ALTIPLANO
Island of the Sun
Copacabana
Katari River
Tiwanaku
La Paz
Illimani 21,201 ft. 6,462 m
Tacna
CHILE
BOLIVIA
Quimsachata Mountains
BRAZIL

ECUADOR
PERU
SOUTH AMERICA
Wari realm A.D. 800
BOLIVIA
Tiwanaku realm A.D. 900
ARGENTINA
CHILE

1500
1000
A.D. 500
TIWANAKU
ANDEAN EMPIRES

WARI AND TIWANAKU began in the high Andes, then expanded into fertile coastal valleys to provision their growing realms. Tiwanaku's influence spread 500 miles south along caravan routes, while the Wari advanced almost twice as far, building roads and irrigation canals along the way. Both empir[illegible] influenced the [illegible], as did the powerful Ch[illegible], who dominated the northern [illegible] of Peru.

[illegible] GREG [illegible]
[illegible] MODEL BY ALAN
[illegible] DESIGN
NATIONAL GEOGRAPHIC [illegible]

[illegible] Once thought to [illegible] a single culture, the Wari and Tiwanaku actually shared little more than [illegible] a [illegible] border. [illegible] if the cultures were ever [illegible] war [illegible] just sustained [illegible] hostile [illegible]. A large Wari ceramic face (below left) [illegible] have been [illegible] much a symbol of rank as [illegible] a gold breastplate from Tiwanaku.

MUSEO DE METALES PRECIOSOS PRECOLOMBINO, [illegible] PAZ

A Bolivian family enters the sunken courtyard of a temple that preceded Tiwanaku and Wari. Such courtyards influenced the ceremonial architecture of both empires.

construction of grand cities, temples, and palaces. They also shared certain religious symbols and beliefs, which they combined with their political policies to control wide swaths of territory and people. And both collapsed about a thousand years ago.

"The Wari and to some extent the Tiwanaku introduced the idea of empire to the Andes," explains archaeologist Katharina Schreiber, an expert on empire building in the Americas who is based at the University of California, Santa Barbara. "That made it easier for the Inca to build theirs, since the people already understood the concept."

Ironically the Wari were largely lost to history until recently. For many years archaeologists regarded the Tiwanaku as the sole inventors of Andean imperialism, in part because the Inca claimed them as their immediate ancestors and said nothing about the Wari. In the past two decades, however, a handful of North and South American scholars have begun to rediscover the realm of the Wari and sort out its relationship to its powerful, more mystical neighbor, Tiwanaku. In doing so, they have also discovered just how much the Inca learned from both cultures about the art and tactics of empire building.

The Wari Empire grew from unpretentious stock, emerging from small farming communities in the dry Ayacucho valley of Peru on the western slope of the Andes. Today Ayacucho is a midsize city with a busy airport and university, yet dig down a few inches—or just walk across a farmer's field—and you'll almost certainly find a broken bit of Wari pottery.

"On every hill around Ayacucho and all the way down the valley to the ancient capital of the Wari Empire [about seven miles away], we find Wari sites," says José Ochatoma, a soft-spoken Peruvian archaeologist from the National University of San Cristóbal of Huamanga. Ochatoma and his wife, Martha Cabrera, recently excavated part of one of the largest of these sites, called Conchopata. In its heyday it was an extensive city of skilled potters who may have supplied the capital with finely painted wares.

Today the site borders and is partly buried beneath the runway of the Ayacucho airport. It is also in the center of a land dispute that has pitted the archaeologists against a group of developers who have started building brick and adobe houses over some of the ruins.

Most Wari sites, including Conchopata and

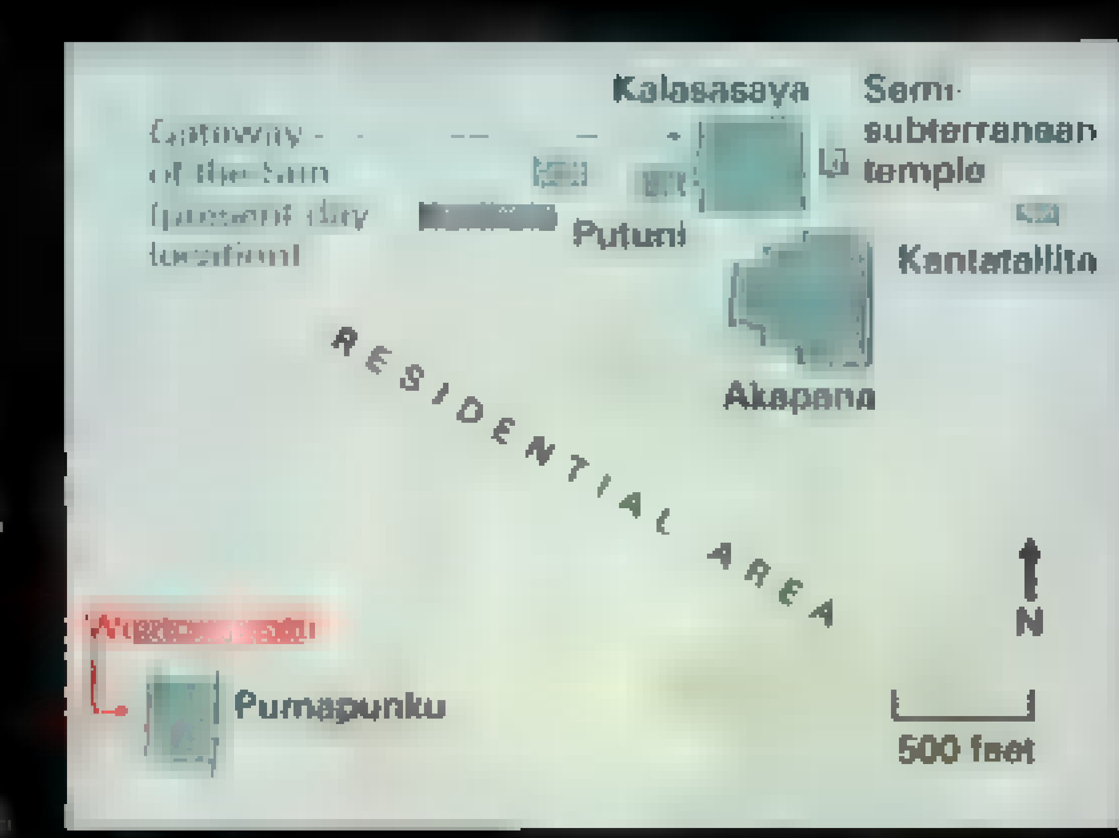
DENSE NEIGHBORHOODS house Tiwanaku's artisans and working-class residents outside the main ceremonial area, which centers on the massive Akapana temple.

FINE TEXTILES woven of alpaca and llama hair probably decorated the temple walls and were also burned as offerings.

THE PUMAPUNKU'S WESTERN GATE may have been the original location of the famous Gateway of the Sun, on which is carved Tiwanaku's supreme deity—the mighty staff god.

PILGRIMS, who may be families, ethnic groups, or entire villages, file into the outlying temple playing panpipes, bone flutes, and drums.

TIWANAKU ANDEAN MECCA Though it began around 200 B.C. as a farming village ten miles south of Lake Titicaca, by A.D. 700 Tiwanaku had grown into a thriving imperial capital (above) with terraced pyramids, palaces, and ingenious agriculture that fed as many as 60,000 people in a hostile land. The Pumapunku temple on the city's western edge is considered one of the best examples of Tiwanaku architecture. The precise fit of the temple's sandstone slabs—weighing up to 130 tons—has spawned far-out theories of extraterrestrial engineering. Researcher Alexei Vranich believes the Pumapunku served as Tiwanaku's Ellis Island, indoctrinating pilgrims from remote parts of the empire into the state religion with *chicha* (a fermented drink), hallucinogens, and ritual theater. When the rituals were over, the converts could proceed to other temples in the city's ceremonial core, like the 56-foot-high Akapana temple, in the background above. A devastating drought around A.D. 1100 may have ended the city's 600-year reign over the south-central Andes.



SACRIFICES were held in a central sunken courtyard. In the llama sacrifice (enlarged below) a standing priest waits to fill a cup with blood. He will then pour it on the monolith behind him to incur favor with the gods.

A PAINTED TERRACE would have been the final touch, though the Pumapunku was still unfinished when the empire fell. Such large public works, requiring enormous labor, may have contributed to its demise.

STONE MASONS (below) connect the blocks in the temple walls with bronze clamps, a technique perfected by the Tiwanaku. Workers pour the molten metal from small ceramic crucibles and then let it harden in place for a perfect fit.

ART BY GREG HARLIN

TIWANAKU

A CEREMONIAL STAGE

CLOAKED IN THE RED COLOR OF OFFICE, *mayors of villages surrounding Tiwanaku inspect the Kalasasaya temple complex, one of the largest and most controversial excavations in South America. While scientists argue over its reconstruction, the mayors recently seized the site from the Bolivian government in order to collect promised tourist fees. Their distinctive ponchos symbolize their villages, just as heads tightly bound in infancy resulted in skull shapes (left) that once distinguished people from various parts of the empire.*

MUSEO ARQUEOLÓGICO REGIONAL
TIWANAKU, BOLIVIA

the Wari capital with its llama-shaped tomb, were overlooked by archaeologists of the early 20th century, who were more impressed by the stone monuments left behind by the Tiwanaku. They thought the remnants of the two civilizations came from one culture, the Tiwanaku, and that these Wari sites were simply the administrative centers of the Tiwanaku people. In the 1930s, however, the Peruvian archaeologist Julio C. Tello recognized that the two cultures were distinct. Since then, researchers have discovered that the Wari left behind a bounty of archaeological remains. Indeed, their capital city, which researchers also call Wari, covers some six square miles.

Only a small portion of that site has been excavated, but enough of the city remains standing for archaeologists to estimate that as many as 70,000 people once called it home. Theirs was a city of stately temples, courtyards, royal tombs and residences, and multistory buildings. Most of the walls and buildings were coated with a layer of white plaster, giving the city a luminous shimmer. From their white capital city the Wari directed the affairs of empire, overseeing everything from pottery making in nearby Conchopata to corn production in distant colonies—and did so without the assistance of writing.

"That's one of the big mysteries," says Gordon McEwan, an archaeologist at New York's Wagner College who is excavating Wari cities in the Cusco valley, about 160 miles southeast of Ayacucho. Before fully understanding the Inca, researchers used to say that "empires could only exist in societies with a writing system," McEwan continues. "But the Wari didn't have writing, and neither did the Inca. So how did these civilizations create their empires?"

Some clues are coming out of Conchopata, where over the past five years researchers have unearthed a bounty of pots and sacrificial offerings that hint at the Wari way of ruling. At first glance the city seems like little more than a rabbit warren of small rooms. Indeed, all that remains today of this once teeming settlement is the low foundation walls of numerous buildings, most arrayed in a grid. In its prime, however, Conchopata, like all Wari settlements, was a highly organized city with residential, administrative, and religious areas. Many Wari religious quarters included buildings shaped like the letter D. (These are not found in Tiwanaku or Inca settlements.)

"For reasons we don't understand yet, they loved the color white," says Ochatoma, standing in the center of one such temple in Conchopata. Most of the floor's plaster has survived, and under the bright Andean sun it glows with the brilliance of a Florida beach.

Although researchers are far from understanding the intricacies of the Wari religion, Ochatoma's discoveries reveal a people who practiced ritual and perhaps state-sponsored sacrifices of both humans and animals. Beneath the plastered floor Ochatoma's team unearthed several pits containing burned human skulls and the remains of sacrificed camelids. (Researchers can't say whether the bones belong to alpacas or small llamas since their bones are so similar.)

To find these offerings, Ochatoma didn't have to excavate the entire floor. Instead he simply tapped it with the handle of his trowel and listened for a hollow sound—a common technique for finding items hidden behind walls or beneath floors.

"Like this," he says. In one spot the white floor rings with an almost bell-like sound, while a few inches away it sounds dull and muted. "If you dig here," he says, tapping the first spot again, "you will find something."

Around the edge of the walls he found hundreds of sherds of beautifully painted and intentionally smashed pots, some the size of wine barrels. Other pits held broken jars decorated with the design of a hallucinogenic plant. Subsequent tests showed that one of the jugs once held *chicha*, the drink Andean people usually brew from corn—then and now.

Both the painted jugs and their contents may have played a role in the Wari's empire-building kit by asserting their connection to the supernatural, explains Anita Cook, an archaeologist from the Catholic University of America in Washington, D.C. Cook and William Isbell have been working at Conchopata for several years, funded in part by National Geographic. The repetition of the pots' images reveals a society intent on power and control, for the potters were only allowed to paint state-sanctioned symbols. From a plastic bag Cook pulls out large pieces of several broken jars, each decorated with abstract representations

A Bolivian woman takes the old way home, walking along the ancient road to Tiwanaku. Roads were vital for controlling an empire, a lesson the Inca learned well.

of condors, felines, and camelids—all symbols of the supernatural in Andean religions, including those of the Tiwanaku and Inca.

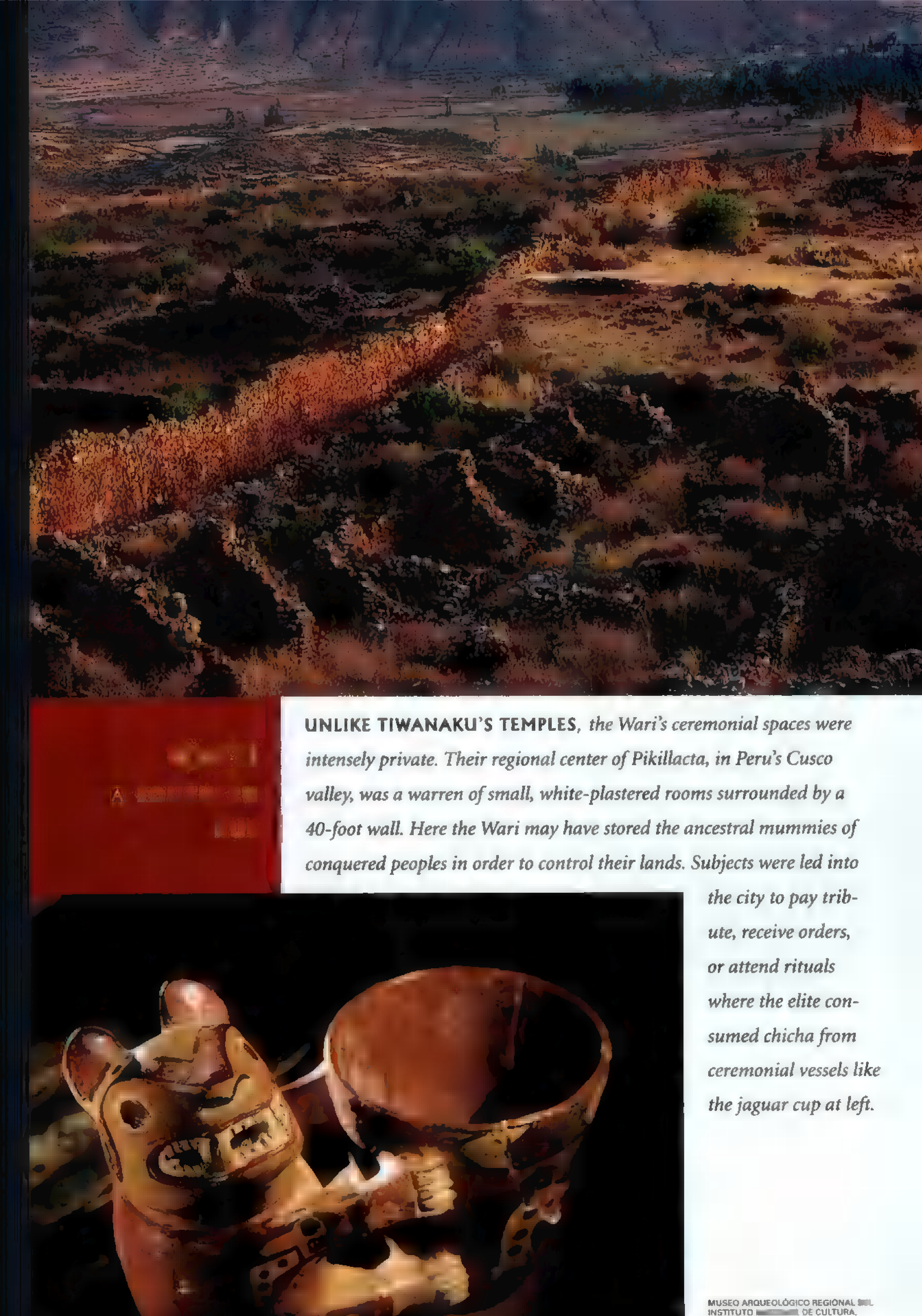
The symbols "go back at least as far as the Pucará people, who lived in the Lake Titicaca basin around 200 B.C.," explains Cook. "We don't know exactly what they are saying, but they are symbols everyone in the Andes would have recognized."

Some motifs don't require any interpretation—and reveal the Wari to be an aggressive people who may have sacrificed those they captured in battle. "That's the simplest explanation," says Cook of the pots depicting severed heads, arms, and legs as well as warriors dressed in animal masks and holding trophy heads reminiscent of the skulls found beneath Ochatoma's temple.

The Wari's jugs were, literally, vessels of state propaganda, carrying messages of shared religious beliefs and of terror and power. "Most pottery production was state controlled," McEwan says. "A lot of pottery was made solely for feasts, then smashed as part of the ceremony. It was a reciprocity ceremony: The lords gave a big feast to thank the locals for their service and loyalty, and everyone drank chicha from the symbolically painted pots" according to their standing in the social hierarchy. During the festivities administrators handed out verbal orders as well, which the local rulers were then expected to carry out.

Some of those orders could be harsh, adds Katharina Schreiber, the expert on empires. Her research shows that in some parts of their kingdom the Wari relocated entire villages, moving the people from high elevations where they had once grown potatoes to lower ones where they were forced to grow corn—a practice the Inca adopted hundreds of years later. The Wari needed huge quantities of corn for their state-sponsored ceremonies since those held the empire together. Subject peoples likely also supplied most of the labor for the Wari's great engineering feats—their multistory cities, their stone aqueducts, and the extensive system of highways that is now often erroneously attributed to the Inca.

"The Wari were definitely a dictatorial people," says McEwan. He suspects that local laborers built Pikillacta, the Wari city he excavated near Cusco, as a way of paying tax to the empire. Like Conchopata and the city of Wari,



UNLIKE TIWANAKU'S TEMPLES, *the Wari's ceremonial spaces were intensely private. Their regional center of Pikillacta, in Peru's Cusco valley, was a warren of small, white-plastered rooms surrounded by a 40-foot wall. Here the Wari may have stored the ancestral mummies of conquered peoples in order to control their lands. Subjects were led into the city to pay tribute, receive orders, or attend rituals where the elite consumed chicha from ceremonial vessels like the jaguar cup at left.*

MUSEO ARQUEOLÓGICO REGIONAL [illegible] INSTITUTO [illegible] DE CULTURA, AYACUCHO, PERU

Pikillacta was carefully laid out in a grid. Viewed from a nearby hilltop, it looks like an engineer's dream: row after row of red stone walls crossing the landscape in perfectly straight lines. Curiously, despite the orderliness of the ruins, Pikillacta would have been anything but easy to navigate in Wari times.

"The walls on either side of us would have been about 40 feet high," says McEwan as we walk down one of Pikillacta's old roads. "There were no windows, so we would have seen only a slice of sky. There were more than 700 rooms but only seven roads. All the buildings would have been plastered stark white, Wari style."

McEwan thinks Pikillacta was a provincial center for the all-important reciprocity ceremonies. "You came here as a guest, perhaps of the local government. You didn't get into Pikillacta without an invitation or a guide. You couldn't have found your way around by yourself." Inside the city, administrators probably handed down orders and dispensed chicha, and priests took hallucinogenic drugs while performing secret rites to summon the spirits and advice of the ancestors.

But it wasn't because of state-sponsored partying that Pikillacta was built to be inaccessible, McEwan says. Rather it was because part of the city may have served as a mummy storage depot. Indeed, argues McEwan, the real control the Wari exercised over their colonies came from their success in capturing local peoples' ancestral mummies and skeletons, then holding them hostage—a practice that effectively turned the living into hostages too since their property rights were tied to their ancestors.

Ancestor worship has a long tradition in Andean cultures, extending back thousands of years—and continuing into Inca times. (Even today many Andean peoples have a deep reverence for their departed relatives.) Details may have differed in each society, but in general people often kept the bones of their ancestors close at hand, stored in urns or baskets where they could be easily retrieved, feted, and called on for blessings and advice. The stored bones also had a practical side: They gave their caretakers land and water rights. They were concrete proof that your great-great-grandfather had worked the land and that it rightfully belonged to you.

"I think the Wari used this belief to create their empire," McEwan says. "They captured other peoples' mummies or ordered them to bring their ancestral bundles to places like Pikillacta for storage. The only access you then had to your ancestors—and so to your land and water—was through the state. If you didn't comply, the Wari destroyed your ancestors, which left you destitute. The Inca did the same thing, but it was probably the Wari's idea."

Pikillacta sat close to the frontier of the Wari Empire. The Wari built a few other settlements farther down the Cusco valley. But the more they advanced to the south, the closer they came to Lake Titicaca and the territory of their chief competitors: the Tiwanaku.

The Inca may have taken the practical administrative methods of empire from the Wari, but they looked to Tiwanaku for matters spiritual. To the Inca as well as to the first Spanish explorers, Tiwanaku was a mystical place of grandeur, temples, and gods. It was where their ancestors had come from, the Inca told the Spanish, implying that the blood relationship gave them the right to rule the Andes. Archaeologists have not yet determined if the Inca's claim to this heritage was valid or merely wishful thinking. But their desire for the connection, researchers say, speaks volumes about the importance of Tiwanaku.

"Everyone in the Andes knew about Tiwanaku," says Alexei Vranich, an archaeologist at the University of Pennsylvania. He is excavating a Tiwanaku temple called the Pumapunku. "The temple was a place of great religious importance and a center of pilgrimage, and it drew people to Tiwanaku. It's easy to see why," he adds. "Watch what happens as we climb to the top of the temple."

Vranich, a square-jawed young man with a scholar's serious demeanor, and I started our climb about a half mile from the temple site, walking up a gentle grade toward the Pumapunku. In Tiwanaku times pilgrims probably began their trek on the shores of Lake Titicaca, some ten miles away and among the most sacred places in the Andes. According to Andean religion the creator emerged from its waters to shape the earth and the first people, and the lake's shores are ringed with the ruins of small shrines and temples dating as far back as 700 B.C. Researchers think that Tiwanaku was originally one of these small religious centers. But in the sixth century A.D., perhaps

A Peruvian woman enjoys a glass of chicha at a bullfight near the ruins of the city of Wari. During ceremonies the Wari drank copious amounts of chicha served from large face-neck jars (opposite), which were often shattered afterward.

MUSEO NACIONAL DE ARQUEOLOGÍA,
ANTROPOLOGÍA E HISTORIA DEL PERÚ, LIMA

WARI

A ROYAL TOMB,
A SHARED [illegible]

THREE FLOORS UNDERGROUND, *archaeologist William Isbell explores a llama-shaped tomb that may once have contained Wari royalty. Though thoroughly looted, the tomb, in the ancient capital of Wari, is the finest example yet found in the Wari Empire of cut-stone architecture—an art form perfected by the Tiwanaku. Both cultures revered the staff god, shown at left on a Wari pottery sherd. This powerful deity was thought to control lightning, rain, and life-sustaining crops.*

because of the lake's central location in Andean mythology or because of the political power of the Tiwanaku people, Tiwanaku became a prime pilgrimage center. Some of these pilgrims probably traveled long distances, crossing the lake's lapis blue waters on reed rafts. Then, like Vranich and me, they would have walked due east over the grassy plains of the altiplano toward the blue-and-white peaks of the Andes. For most of that journey the highest of these, Mount Illimani, would have pulled them on "like a beacon," Vranich says. "Illimani was their most sacred mountain, where they believed many ancestors went when they died."

At a certain point along the pilgrimage path Illimani suddenly disappears from view. In its place rises the Pumapunku, a pyramid-shaped temple with a flattened top that the people of Tiwanaku created from packed earth and stone. Most of the temple is now in ruins, its huge stone slabs lying askew as if some willful giant had knocked them over. During the ancient pilgrimages, however, not a trace of stonework would have been visible. Instead Vranich envisions that the temple walls would have been covered with sheets of beaten gold and silver as well as colorful textiles threaded with flecks and beads of precious stones and metals; its packed clay floors would have been brilliantly colored with layers of deep red, blue, and green paints.

"It must have been overwhelming," Vranich says, "a mind-altering, life-changing experience made even more so by the drugs they were taking." A hallucinogenic cactus, other hallucinogenic plants, drug paraphernalia, and snuff have been found among Tiwanaku's ruins. Recently another archaeologist uncovered the mummy of a shaman with his packet of drugs and medicines.

Vranich believes that the Tiwanaku architects knew exactly what they were doing when they sited the temple to hide the mountain. "They knew the effect it would have, that Illimani would disappear," he says. "It was one of the optical illusions they created here."

Only when you climb the very last stair and reach the temple's flat summit does the mountain reappear, blue and white and shining.

"Now look around," Vranich says. "Illimani is before us, Lake Titicaca behind us. In the Andean cosmology this spot really does mark a place between heaven and earth."

The Pumapunku is only one of several temples and elaborate courtyards with stone statues and carvings that the Tiwanaku built over an area covering two square miles. They surrounded this religious center with a moat, creating in essence a miniature lake with the temple complex as an island in the center. "They entirely transformed the landscape, integrating it into their own religious beliefs," says Alan Kolata, a University of Chicago archaeologist who has directed excavations at Tiwanaku since the late 1970s.

The central temple, called the Akapana, was built in a series of seven levels, apparently to resemble the nearby Quimsachata peaks. To make it even more like a mountain, the Tiwanaku plumbed the Akapana with drains so that when the annual rains arrived, water would thunder through it. "It was a way of renewing the earth and maintaining the circulatory system of the universe," says Kolata, who thinks the Tiwanaku probably celebrated fertility ceremonies and other rites while the water roared through their mountain-temple.

Other ceremonies were grimmer. Like the Wari, the Tiwanaku were aggressive and celebrated their victories by sacrificing captives. Dismembered remains have been found around the Akapana. Perhaps some were the mummified remains of their enemies' ancestors, while others were warriors captured in battles. Also like the Wari, the Tiwanaku decorated their ceramics with gruesome scenes of puma-masked warriors holding severed heads in their hands or wearing belts of trophy heads, their tongues out and eyes rolled back.

At their peak between A.D. 700 and 1000 the Tiwanaku controlled nearly the entire Lake Titicaca basin as well as lands to the southeast in Bolivia and to the southwest in Chile. Superb engineers and farmers, like the Wari, the Tiwanaku turned the broad valley of the Katari River, which feeds Lake Titicaca, into their capital's breadbasket, using extensive canals and causeways to irrigate 30 square miles of raised beds for corn, potatoes, quinoa, and other crops. "They actually altered the meanders of the river," says John Janusek, an archaeologist at Vanderbilt University who excavated several nearby Tiwanaku settlements, "and turned it into a straight shot through the valley." Remains of the ancient raised beds are visible today, and the river

From its origins as a sacred doorway to its modern role as Bolivia's national icon, Tiwanaku's massive Gateway of the Sun left an enduring lesson for empires that followed: Never underestimate the power of time.

still courses straight down the valley as the Tiwanaku shaped it.

Apparently the Tiwanaku needed massive quantities of corn, potatoes, and coca to feed and impress the pilgrims who flocked to their temples. "That seems to be their main motivation in expanding," Janusek says. Archaeologists don't know yet if the Tiwanaku forcibly moved villages, as did the Wari, but they do think that the Tiwanaku had a more open society and that the ceremonial city was not as tightly controlled as Wari cities like Pikillacta.

"Tiwanaku was a very cosmopolitan city; it pulled people in," says Deborah Blom, carefully placing two skulls found at Tiwanaku side by side for comparison. A physical anthropologist at the University of Vermont, she is studying the movement of peoples within the ancient kingdom and has discovered that people from every corner were apparently welcomed here. The two skulls vividly illustrate this point.

"People shaped their skulls very differently in different parts of the Tiwanaku territories," Blom says. "They wrapped their babies' heads with cords or tied boards to their heads to give them a special shape." Later, as adults, they would wear hats that fit the distinctive shape of their skulls. One of Blom's skulls has a long, tubular shape reminiscent of a volcanic peak and perhaps altered to look exactly like that. The other is squashed flat from front to back so the sides bulge. "The tubular ones are people from the eastern side of the lake, while these flattened ones come from Moquegua, close to Peru's south coast," Blom says. Based on genetic research, it appears that "they traveled

here and intermarried." Blom has yet to discover any sign of Wari settlers (who simply flattened the backs of their skulls).

The Wari and Tiwanaku may not have wedded each other, but there is no evidence that their relationship was militant either. Both realms had colonies at Moquegua, a warm region well suited to growing corn, yet even here there is no sign of battle. "They were the big, important states of their day," Schreiber says, "and they must have interacted, but we don't know how."

Researchers are still studying the time lines of both kingdoms. Some say Wari collapsed first; others argue that it was Tiwanaku. Did one conquer the other, or did a drought bring them both to their knees? Whatever the cause, the empires apparently ended suddenly. At Conchopata the potters dropped their tools one day and left, maybe driven out by some as yet unidentified invader. And at Tiwanaku the stonemasons stopped their monumental construction projects, leaving temples unfinished and abandoning several huge blocks of andesite along the shores of Lake Titicaca. They lie there now on the grass like great beached whales, their purpose forgotten.

Yet between them the Wari and Tiwanaku had created something in South America's Andes that never completely vanished: the idea of empire. Four hundred years later, building on their foundations, the Inca emerged to revive it. ☐

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For more on chicha, the beer brewed long ago and still popular today, go to **nationalgeographic.com/ngm/0206.**
AOL Keyword: NatGeoMag

ZipUSA

AMES, IOWA

Matt Bonsall, sophomore, [illegible] arts. Owns two dog collars. Wakes up happy to live in Iowa State University's [illegible] Hall. "When I go home, my parents want to lock me up. They don't want the town to gossip about what I wear."

50012

Recipe: Remove hundreds of teenagers from their homes, place them

BY HILLEL J. HOFFMANN
ASSISTANT EDITOR

PHOTOGRAPHS BY SCOTT HOUSTON

Melissa Sloniger, freshman, dairy science, Iowa Army National Guard, 1034th Quartermaster Company. Keeps a photo album of the family cows in Friley Hall dorm room. (Her pet cow Swiss Mocha attended her high school graduation party.)

in three dorms in the middle of Iowa, etc.

Temple of the Screen In 50012—one of the only U.S. zip codes populated solely by college students living in dorms—residents usually can be found a few feet from a television or computer monitor. "We play video games at least half the day," says freshman Tyler Manker (above, at right). He's exaggerating. A little. He estimates that he spends five hours a day playing video or computer games, two hours watching TV or videos, and an hour on the Internet. Oh, yeah—he also spends three hours in class and an hour or two doing homework.

A handful of students give joysticks a rest at a Bible study session (below) in Friley. Life in the cheerfully profane world of the dorms isn't easy for some Christians, but senior David Schladt, at right, doesn't mind the language that drifts in from the halls. "It tests my faith," he says.

50012

POPULATION: 2,000
PERCENT FRESHMEN: 59
PERCENT MALE: [illegible]
PERCENT IOWAN: 66, many from towns with fewer people than the dorms
MILES OF HALLWAY IN FRILEY HALL: Five
NUMBER OF LUNCHTIME PIZZA SERVINGS IN FRILEY CAFETERIA: 1,771
BREAKFAST CEREAL CHOICES: 29 (Led by Cinnamon Toast Crunch, with 800 servings a week)

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Girls versus Boys Sophomore Alexandra [illegible] gets the good news: the sisters of Alpha Xi Delta have [illegible] to her room in Friley Hall with balloons, a rose, and a bid to join their sorority. She feels she has outgrown the coed dorms. "I want to be able to walk down the hall barefoot and not contract [illegible] deadly disease," she says. "The boys are the worst—they're loud, and they're just naturally smelly."

"I agree with the loud part," says freshman Tyler Mullenburg (below). His room in Helser Hall is the [illegible] of every known species of heavy-metal music. "I love listening to music," he says. "It's pretty much all of my life." Here's the sound track in his corridor: *CHONKA-CHONKA-CHONKA-CHONKA* (repeat until weekend "quiet hours" begin at two o'clock in the morning).

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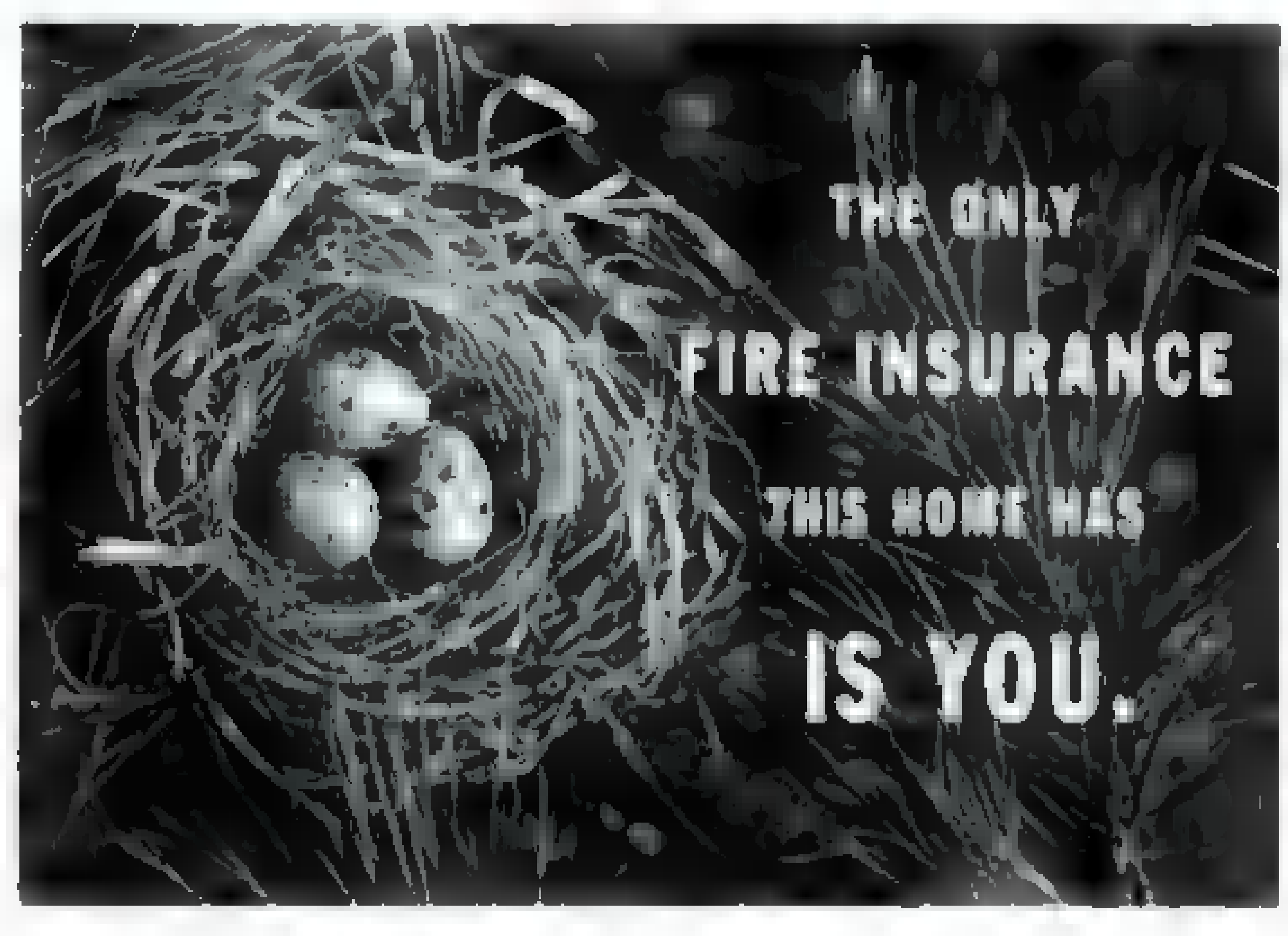

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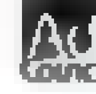
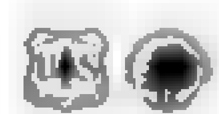

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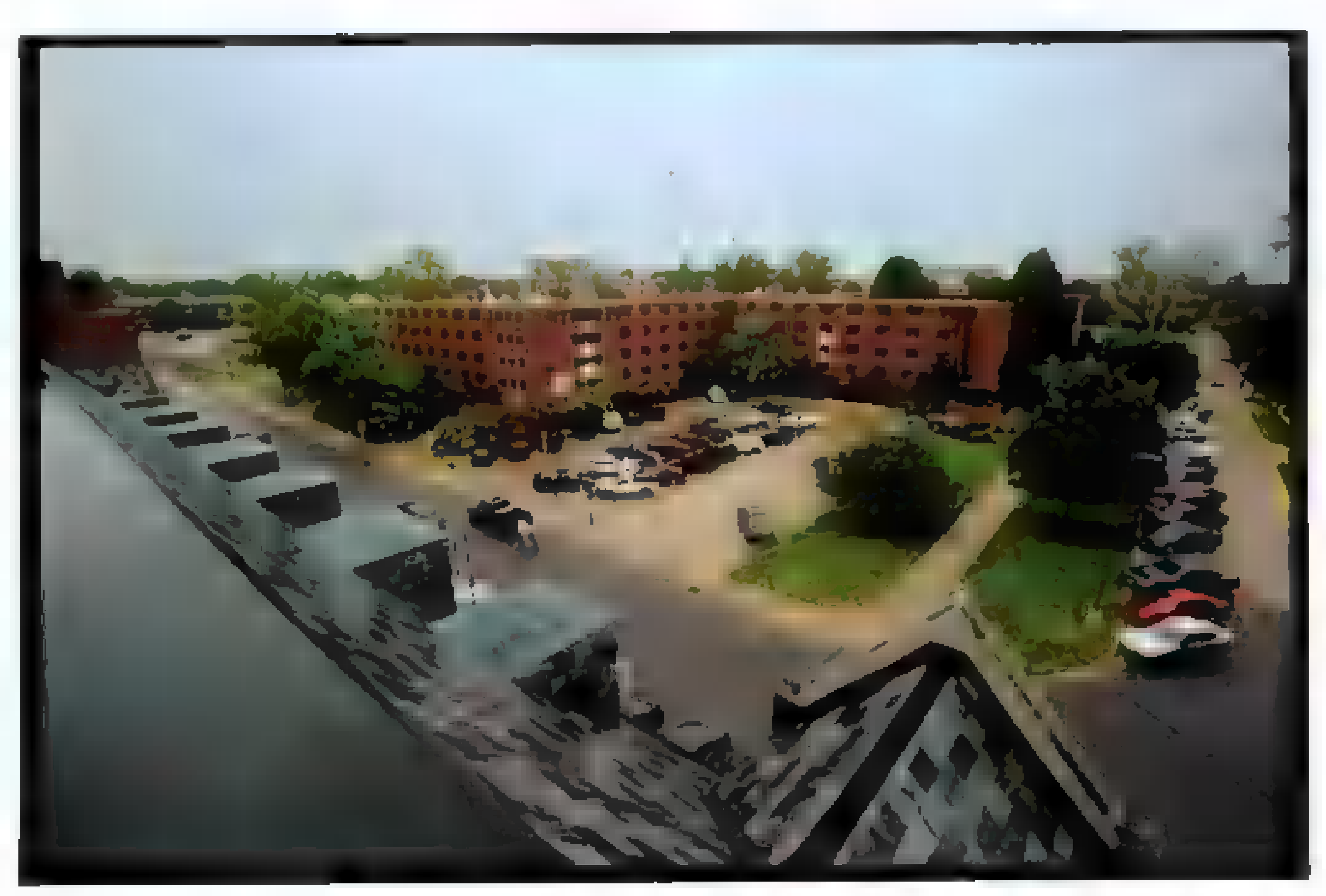
"Just chillin' " Freshman Sandra Leyva (above) and her Latino friends gather after dinner for a smoke and the pleasure of speaking Spanish after a day full of English. A Cuban-American from Oklahoma who spent years in Puerto Rico, Leyva walks comfortably in two worlds. It's more of a struggle for her friends. "A lot of them have never seen snow," she says. But most Latin American students seem to love it here. "I thought I was gonna get in fights every weekend," says Luis Iguina, a sophomore from Puerto Rico, "but everyone has opened their doors."

Dorm room doors are often open in Friley Hall (above), Helser Hall (below, seen from the roof of Friley), and Westgate Hall (a small dorm slated to be demolished). Maybe open doors are a midwestern thing. Now if they'd just turn down the music. □



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LOIS RAIMONDO, *THE WASHINGTON POST*

AFGHANISTAN

A Fragile Future

A boy going to market in Khvajeh Ghar passes in front of the photographer's rented jeep, with its shattered windshield and poster honoring slain anti-Taliban leader Ahmad Shah Massoud. "This image is more of a thought than a photo," says Lois Raimondo. "For me, the child walking into that spiderweb represented the complexity of the Afghan future." While in the country, Raimondo says she encountered humanity at its extremes. "There were desperate people who gave in to violence and brutality, but there were also those who withstood the odds and went about their daily lives with grace and dignity while the war was going on just over the hill." Though the Taliban is on the run, Afghanistan and its coalitions, says Raimondo, are "very, very fragile."

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Cut it or keep it? Find out what tipped the balance for this photo and send it as an electronic greeting card at **nationalgeographic.com/ngm/0206**.

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ON ASSI

ON THE ROAD, IN THE FIELD,

AFGHANISTAN

The Wonder of the New

A photographer documents the war digitally

Many members of Afghanistan's Northern Alliance had never seen computers before, so the backseat of Lois Raimondo's car, where she edited digital photographs on a laptop and sent them home to her editor at *The Washington Post* on a satellite phone, was a cause for wonder. "Wherever I went in Afghanistan, I'd have crowds because of the computer," Lois says. But to Lois, the important thing about the car was that it had a cigarette lighter, which meant she could charge her computer batteries, her satellite phone batteries, and her digital camera batteries. "I almost lived out of that car," she says. "I had to write stories, shoot, and file from the car—when I wasn't on horseback."

Lois spent two and a half months in Afghanistan at the height of the fighting that drove the Taliban from power. "I was supposed to go to Pakistan, but my editor changed my plans," she recalls. "I had a week to get ready. I'd never used a satellite phone, digital camera, or laptop before. I had to buy a sleeping bag and hundreds of Power-Bars. I carried everything with me; if I'd lost one cord, I would have been dead in the water."

THE WASHINGTON

FRANCE

A D-Day Mosaic

CLAIRE GUILLOT

Peering out of an old German bunker, now part of a museum on Normandy's Utah Beach, senior researcher **David W. Wooddell** (right) scouts out the sites where ships sank and men died. "You know people have paid a terrible price for something that was vastly worthwhile," he recalls thinking.

David began his research for our D-Day article by reading every book he could find on the subject, surfing the Internet, "looking for the best documentary sources available." Then he spent the equivalent of two weeks in the National Archives looking for maps and aerial reconnaissance photographs. "I was a photographer before I came to the magazine, so I shoot my own copies of historical photographs," he says. Finally, he went to France for a week, visiting museums devoted to the invasion, seeking artifacts and other visual material.

BRIAN J.

While in France, David worked with Bertrand Sciboz, a French diver who owns a company in Normandy that maps wrecks of all ages off the coast. "At NATIONAL GEOGRAPHIC we have the resource of time to develop information in detail, a luxury few other magazines have," David says.

David's research greatly aided our photographers, as well as author **Tom Allen** (left, in Port-en-Bessin in front of a U.S. Sherman tank that sank during the invasion and was pulled from the sea). Tom, who has written several articles and books about World War II and the people who fought in it, set out with the goal of covering the part of the invasion that has received minimal attention over the decades, the delivery of men and materiel to Normandy's beaches.

"I've had the privilege of talking to people who helped win the war," reflects Tom, 73. "You find a survivor and you find one little piece of the mosaic of that day, of the memory we're all supposed to have of D-Day. I put my story together from their remembrances."

WORLDWIDE

At a street festival in the Peruvian village of Huanta, author **Virginia Morell** was greeted by a group of youngsters who were eager to try out their English. "So we talked, they in their broken English and me with my broken Spanish, and they welcomed me to their country," Virginia says. Reporting on the lost empires of the Wari and Tiwanaku, she found that a lot of current religious and social customs, including such local fiestas, follow Inca, Wari, and Tiwanaku practices. "It gives you a feeling for the continuity of human beliefs," says Virginia.

Scottish-born **Scott Houston** specializes in photographing young people, so working on this month's zip code feature at Iowa State University in Ames, Iowa, came naturally to him. "Living in a college dorm was no problem," Scott says. "It was positively luxurious compared with some situations I've been in." Scott's roommate, Assistant Editor **Hillel Hoffmann,** was also at home on campus. Born in Boston, Massachusetts, while his parents were college students, Hillel grew up in Ithaca, New York, where his father is a professor at Cornell University.

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Flashback

ERNESTO CAGNACCI

AFGHANISTAN

The Social Whirl

Men perform the *attan* in a village near Farah, in southwestern Afghanistan. This traditional Pashtun folk dance, a staple entertainment at weddings, is accompanied by the ever faster beating of drums. Participants—including, occasionally, women—spin for hours on end, until exhausted.

This photograph, received at the Society in 1948, was never published in the magazine, but by then NATIONAL GEOGRAPHIC had a long history of covering the country, including Maynard Owen Williams' October 1946 article, "Back to Afghanistan." Invited to a tribal wedding, Williams did not photograph the "girls in bright silks and heavy coin necklaces . . . ranged against the sky. The camera could not catch the scene, for in Afghanistan," he wrote, "a lens, like a gentleman, sees only males."

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You can send this month's Flashback as an electronic greeting card and access the Flashback photo archives at **nationalgeographic.com/ngm/flashback/0206.**

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